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THE SPIRIT OF MANUAL TRAINING.

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AN observant foreigner once said of America, "I found progress in everything except in their schools and churches." One must take with a grain of allowance the impressions of foreign tourists. They are solicited so importunately by the objects of the senses that they fail, as a class, to appreciate the real significance of American institutions. But there was, nevertheless, not a little truth in this brief criticism. The schools and the churches have not kept pace with the march of events. Perhaps one notices them straggling the more, because of all institutions they are supposed to be the most jealous guardians of the interests of humanity. Yet in hundreds of communities the land over the masses of the people are but half persuaded of the utility of the one, and treat with increasing neglect the ministrations of the other. While these protestants against our current scholasticism and ecclesiasticism were few in number, their complaint attracted little notice. Now, however, that their ranks are grown to large proportions, a deep importance attaches to the question as to whether these institutions are, or are not, properly fulfilling their functions.

The hand of Destiny never seemingly pointed with more unerring certainty to an impending change than it does to-day as it stretches out toward the school and the church. The office of the teacher and the office of the priest are passing the review of a thoughtful public sentiment. Of the failure of the Church to justify her proud title of "the institute of humanity" little need be said. But, however imperfect one may regard her present ministrations, he can scarcely withhold his affection from an insti-

tution which has done so much to encourage the sentiment of worship. The liberal movement, the impulse toward Christian unity, the substitution of ethical for dogmatic teaching, the appeal to the soul of man rather than to his credulity, all seem to indicate that the Church, which has been so much in the past history of the race, is yet to adapt herself to the changed conditions of the times, and still be an important factor in its future.

But of even greater importance are those changes which seem imminent in the school. Its influence comes at an age when the mind is particularly plastic, and when life is new and fresh. It occupies the attention during the greater portion of at least five days in the week, and even during the remainder it is seldom absent from the thoughts for any considerable length of time. One can scarcely overestimate the importance of establishing so pervasive an institution upon the right basis.

It may seem a trite thing to particularize again the function of an old institution like the school, yet it is only by keeping this very constantly in mind that one can appreciate its present position, or pass intelligent judgment upon those innovations which have been proposed for its improvement.

The school, in the first place, then, is a means and not an end. It serves a purpose. It is not, like the state or the church, an organism and possessed of life. One can construct no pleasing ideal of what the perfect school ought to be. He can at best only specify what results it should produce. Like all other tools, its function is to form and to fashion. A machine is not valued for its proportions, its color, its material, but for its subserviency to the work required, and for the character of its products. The point demands emphasis, for educators too frequently look to the symmetry of the school itself instead of to the harmony of its results. They forget that different materials require different tools for their working.

It is a curious thing that the human mind should so delight in the idea of stability, and should attempt to attain it, when such an idea finds no place in all nature. Even the crystal, the most unchanging object of our admiration, has undergone innumerable births and deaths. All nature is in a state of solution and of flux. There is no stability, even comparative, except where there is no life. Yet we, who believe ourselves to live best when we are in the most perfect communion with that infinite intelligence whose manifestation we call Nature, are constantly denying our faith by the profane effort to give permanence to that which is essentially transitory. Our laws seem to us good. We crystallize them into a code, and so burden the generations to come with an evil mortgage upon their justice. Our faith seems to us divine. We kill it by formulating it into a creed, and so starve the souls of our

children. Oppressed with weariness, we paint our heaven as a place of eternal rest. As well might we extol the lifeless moon above the sentient earth. It is no wonder that men fear death, and hear with chill delight the holy name of heaven. Through all our human institutions there runs this same unnaturalness and inconsistency acting like a constant brake upon our progress. In theory we adore this progress, but the seraphim of our secret altars are insoluble, infusible, unchangeable. In the school this inconsistency of ours has been particularly glaring and particularly disastrous. We have found our imagination of sufficient compass to span the distance between man and protoplasm, but it seems to have halted at the less difficult task of recognizing that the principle of evolution is still working, and that the educational demands of one age are not the demands of all ages.

The cause of education, however, will be but poorly served if one demolish without building up again with as much zeal as he tears down. Nor must one complain too bitterly of an institution which, in spite of its short-comings, has assisted to produce in the community a culture sufficient to recognize them. But it would be well to remember that the school can never be made to conform to any crystallographic habit, however beautiful. Let it be regarded as what it is, simply a tool and a very plastic one at that, not too sacred to be sharpened and altered, whenever by so doing it can be made to accomplish better work.

The great question, then, concerning the schools is a very simple one: What effect has the institution upon its pupils? What sort of men and women does it make out of them? It is not what studies are taught, or what accomplishments are imparted, or what extent of information is bestowed. These considerations have their proper importance, but they are secondary; the real test is deeper. The standard so far has been too material. We want now something more spiritual. It is a truism to say that the function of the school is not to instruct, but to educate; but it is a truism which has not yet been taken sufficiently to heart to be translated into a fact. Struck by the manifest inadequacy of the ordinary school in preparing boys to meet the problems of life, a somewhat vehement reformer has declared that America has succeeded, not because of her public-school system, but in spite of it. The exaggeration is evident. There are many, however, who can not help feeling that as a moral force the modern school, whether public or private, has been scarcely less than impotent. It has given itself up to the business of instruction, and has found little or no time for the infinitely more important work of development. The whole force of the school should be devoted to the one supreme issue—the boy himself. If, while you are making a man, you can also make a scholar, it will be well, but look to the man

first. The majority of thoughtful people, if questioned, would, I believe, make answer that their own spiritual enlightenment had come from literature that happened to fall within their reading rather than from either pulpit or college chair. It looks very much as if we were leaving to chance—if there be such a thing—what ought to be the object of our mightiest effort.

I should deeply regret any exaggeration of the deficiencies of the school, but I think that I do not err in stating that in many of these institutions the work of true education would be better accomplished were the formal instruction now in vogue entirely abolished, and the children simply brought into daily contact with some living, spiritually-minded man or woman, and through them with the questions of life and with the rich literature of the race.

The end of education being discipline, it is manifest that the subjects chosen for study are less important than the spirit in which the study is pursued. In the atmosphere of a school where this sentiment prevails, almost any curriculum will produce living men. But there are certain branches of study which, better than any others, are calculated to provoke thought and serve the ends of education. There are certain ways of spending the time that promise the richest harvest. To select such studies and employ such modes is indisputably the function of those who attempt to guide the course of education. In this all are certainly agreed. Yet that old notion of the ideal school still hinders the search after these admittedly good things. In many schools the course pursued is much the same as if we mixed the colors on our palette with our eyes shut, and still expected to get the tint desired. The discrepancy between the end sought and the method employed would discourage any one less sophisticated than the average school-man. Hygiene, for example, is taught in rooms so ill-ventilated that the children are fairly pale. Grammar and parsing are inflicted in the blind hope that they may in some occult way influence the language of the child. They rarely do. On some unaccountable theory of culture years are devoted to languages that one will never use, and precious moments squandered on the geography of places one will never see or hear of. And so one might follow the entire list of studies undertaken in the majority of schools. They seem hopelessly inadequate.

In the face of such wide-spread failure it would appear that this search after a suitable scheme for the disposition of the time of children must be very difficult. The truth is, that it is difficult to the verge of the impossible, if one proceeds in this credulous fashion, selecting studies and occupations which bear no relation whatever to the result it is desired to produce, and then calmly trusts that by some alchemistic process these base metals will be transmuted into gold. But the task is not difficult if one goes

about it in the right way. And the right way, here as elsewhere, is the natural way. A definite result is wanted. Let definite means be taken to reach that result. If strong men are wanted, let the conditions of the school be such that strength will be a necessity. In many of them at present it is not even a possibility. If honest men are wanted, let the training of the school tend to that end, even if one's knowledge of Timbuctoo and the Karakorum Mountains is not very definite. If self-reliant men are wanted, let education take the place of instruction. If useful men are wanted, let useful things be taught. If thoughtful men are wanted, let the appeal be made to the individual reason of the boy rather than to external authority. All this is very obvious; it is merely common sense, but unfortunately it is not the method of the schools. In a word, the problem of education is to be approached from the other side. We are to work backward from results. Instead of assuming certain studies to be useful, and then working on to decidedly variable results, we are to begin with results admitted to be worthy, and then work backward to a curriculum as varied as Joseph's coat if individual cases demand it. What the true educator most wishes to influence is the conduct of life. The object he holds sacred; the methods by which he compasses it, indifferent.

This is the spirit of manual training. Where this system of education has been introduced, it gives so distinct a character to the course of study that it has loaned its name to the school as a whole. In many respects this is unfortunate, as it has caused serious misapprehension in regard to the purpose of such schools, but apparently the name is now too well rooted in educational nomenclature to be easily changed. It should be borne in mind, however, that the name stands for an object rather than a method. The manual training school has sprung into existence for a purpose much more profound than that of merely cultivating the hand. It has come in recognition of the growing demand for a complete man. Our educational methods have too long been at work turning out fractional products, men strong perhaps in this or that particular department, but sadly deficient when viewed from the standard of complete manhood. The specific purpose of such schools is to offer an education that includes as far as possible all of the faculties. Its favorite maxim is, "Put the whole boy to school." Its mode of carrying out this purpose is the very practical one of occupying the time in any way, formal or informal, that will best lead to the end proposed.

The manual training school is now in its formative period, and the time is a critical one. Two rival theories contend for the mastery of its future. The one regards manual training as an end in itself, and subordinates education to technical skill. It con-

cerns itself more with the production of artisans than of men. This view of manual training makes the school very much akin to the trade and industrial schools, and would end by converting it into a shop. The school is heralded as the legitimate successor of the apprentice system, and as an institution whose highest end is to restore the advantages lost in the abolition of that system. According to this theory, the ability to do becomes the standard of success for the school, and the chief object of its ambition, the production of well-executed handiwork. The results of the year's work would be summed up in an exhibition of things.

The other theory also sees in the school an establishment for the fabrication of a definite product, but it is a product too subtile to find its complete expression in wood or iron or clay. It is believed that the specific purpose of education is to cultivate character, to induce sound thinking, and to make a necessity of scientific inquiry. Its highest end is ethical. Of great value, but secondary to its supreme purpose, are the skill and the information which would be the natural result of such cultivation. The aim of the school is to prepare for completeness of life. The central thought in its entire organization is always the boy himself, and everything that is done, every study that is taken up, every influence that is brought to bear, has for its sole purpose his development. In this view of its proper function, the school is a purely educational institution, and is industrial only in making use of the tools of industry to accomplish its chosen purpose. The manual work, like the work in science and literature, is simply a means of development. It bears the same relation to the process of education that a railway train does to travel. One may select slower modes of approach if he choose, but, in his delight at the rapid transit, he must not confuse the journey with the end for which the journey is made. Those who hold this view of manual training, watch with sincere regret any encroachment of that spirit which places the inanimate product, however ingenious and beautiful it may be, above the human product. The object of manual training, they believe, is the production of thoughtful, self-reliant, honest men.

It will be seen that these two theories are antagonistic. The first, in its anxiety for material results, is somewhat impatient at the slower unfolding of the spiritual handiwork. The second, while it admits all the claims of the first, objects to their limited scope—they do not go far enough. It believes thoroughly in men and women who can do something, but it believes also, and more thoroughly, in men and women who are something. Both theorists sow in all sincerity, and reap as they have sown. One harvest is gathered before the other. The seed matures early, and blossoms and bears fruit in objects of beauty and utility. There

is much to exhibit on stated occasions to the public gaze and commendation. The other harvest is slow in maturing. It taxes faith and hope. It does not offer material well suited for public display. Yet this intangible result is so valued by those who labor for it, that they are content to wait, persuaded that a well-spent present can afford to leave the future to divine law.

In nearly every manual training school these two elements are present. In one way this is an advantage, for they act as a check upon each other. The practical side is kept from becoming sordid; the spiritual side from becoming visionary. But the balance of power between the two is of the utmost importance, for it determines the character of the school. If it be on the one side, the tendency of manual training must be regarded as unfortunate—the educational ideal is degraded; life contracts. If it be on the other, no finer nursery can be imagined for the rearing of a race which shall be strong in its passion for goodness and for knowledge. It teaches that the worth of a man lies in what he is. The question is one of fiber, not of veneer.

It is not unnatural that an enterprise with so ambitious a purpose should constantly bring disappointment to its projectors. When one has poured out his whole soul in an effort to regenerate, even a reasonable amount of success does not satisfy him. He looks, perhaps, for too much. The currents in human affairs which do not make for righteousness are too strong to be easily stemmed. The influence of the school is working against very powerful counter-influences. Arrayed against it are the low maxims of the street and the market, the sensationalism of much of our current literature, and not infrequently the indifferent moral atmosphere of the home itself. It is not alone that these opponents have contemporary power, but they have been in office for from thirteen to fourteen years. We have to fight not only the present, but the past as well. The leaven of the new ideas goes frequently into very obdurate dough, and its working is correspondingly sluggish. We must cope with both the boy and his great-grandmother.

A difficulty keenly felt in these schools is the necessity of spending the first few months in the negative work of undoing. Children, as a rule, are very badly trained. They are taught to work under a false stimulus, and from vicious motives. Their morality is generally the morality of rewards and punishments. Were the childish heart less beautiful and less pure than it is, the injury done to it would be even more irreparable.

Nor are these the only difficulties. The spirit of manual training is ethical and evolutionary. But, unfortunately, not all of those who presume to teach in such schools have themselves caught its fine meaning. One can not communicate what he has

not. Men will teach for bread and butter just as they will preach and pray. Too many are in the school because they have nothing else to do. They have not elected teaching. Like their boys, they must undo a great deal of their past, and this in a man requires not a small degree of plasticity. Some possess it, some do not. To look within the soul and draw one's inspiration from that well of living water is not given to all men; to communicate it, in all frankness and generosity, to but few. Our education has made us all too cautious. We are too afraid of speaking out and expressing our inmost convictions. And so our goodness, if we have any, does not prove contagious. No wave of spirituality proceeds from our teaching.

In contending against these odds, the pressure from without and the insufficiency within, the teacher experiences alternations of hope and despair. The faculty of a manual training school is commonly made up of young men. The more thoughtful among them have been attached to the movement by its immense promise, but under their hopefulness there is observable a current of almost premature seriousness. It is a grave task to undertake the regeneration of humanity, even when it is in the bud.

In attempting to carry out this idea of boy development, the atmosphere of the school is an object of constant solicitude. Great care is taken that it shall not be charged with the miasma called information. It is to be kept fresh, and, above all, morally wholesome. Character is to be grown there, but one spirit must pervade the school; it is that of a divine egotism. The boy is taught that for himself the one object of supreme importance in the whole universe is himself. His gaze is directed toward the naked human soul, stripped of the false props of apparel, of family, of possessions, even of knowledge. He is led to do this and that not for the sake of the product, although this is duly valued, but for the sake of the doing, and the reaction it will have upon himself. Education is thus made intensely subjective. The worth, the dignity, the responsibility of the individual are given greater emphasis than the facts of geography, of grammar, or of history. It is in this spirit, the constant recognition of a definite end, that manual training attempts to work. It would not do, however, to talk to boys very much about the soul. It is an abstraction to them, and they would soon cease to listen. They must be made to feel it. The task is a very subtle one; its nature must never be forgotten, but seldom displayed. The kingdom of heaven can not be taken by violence. It is through gentleness and patience, through love and sympathy, that the inner recesses of boys' hearts are to be reached. They have been taught in a vague way that the body has a soul. The statement is here reversed, and they are made to feel, if possible, that the soul has a body. They

come to the school deeply impressed concerning the objects of the senses, the concrete. They are here persuaded of the greater reality of the spirit; and appreciation is asked for the abstract and impersonal. So far these objects might be the objects of any school of high principle. They represent the spirit of the new education. But they belong peculiarly to manual training, since it is a system willing not only to cherish these sentiments, but also to work with complete singleness of purpose for their realization. It is a sincere and practical effort to do something better than has yet been done in the name of education.

The methods of manual training are too new to have been encumbered with any traditions; nor have they attained sufficient fixedness to threaten growth. For the most part, they are still tentative and experimental. This plasticity is very hopeful. A question left open is a constant stimulus to renewed searching after something still a little better. Each school that attempts to carry out manual training soon develops a certain individuality. Any teaching so intensively subjective as this is deeply influenced by the personality of its faculty. The character of the men who have it in charge is quick to find expression in the school. The distinctive features in the institution at Philadelphia are, perhaps, the predominance given to ethics and the unremitting effort to preserve unity throughout the many-sided development attempted. In defending our unity we are beset by difficulties. The over-enthusiasm of our friends would plunge us into many excesses. Manual training seems to them so good a thing that they can not realize the possibility of having too much of it. We who take the long view have often to counsel moderation, or the new idea would quite run away with us. In the intense delight which these good people feel in giving substance to ideas, they would discard everything which is not capable of such expression. They apparently forget that imagination is absolutely needful for perspective, and that of all useless, pitiable creatures the unimaginative man is superlative. Yet this excessive amount of representation would quite kill imagination. In careless hands the effect of manual training would be to set bounds and limits rather than to break them down. It is not a system that can be indiscriminately recommended. Men are so prone to mistake the means for the end, that those who esteem manual training most highly are least willing to encourage its introduction, unless they know the character of the men who are to have it in charge.

In its organization the manual training school differs little from the customary high school. It is an institution of similar grade, and covers about the same period of boy life. Its students enter at from thirteen to fifteen years of age, and remain, if they

complete their entire course, for three years. It is not less literary and not less scientific than the best of our high schools, but it is, we believe, far more practical in preparing boys to meet the real problems of life. The customary high-school course covers four years, but, as only a small percentage of students remain to graduate, it is thought wiser in the manual training school to limit the course to three years, and to offer a fourth year of post-graduate study in any department where a student has shown special aptitude. One third of the school day is devoted to manual work, and the rest to science and literature. It seems impossible, however, to consider such a school except as a whole. It refuses to be divided into sections. Representing, as it does, a purpose rather than a method, all departments are bound together by a common aim, and are subservient to that. They are members one of another, and the head no longer says to the hand, or, for that matter, to any other member of the anatomy, "I have no need of thee." We venture to hope that the impulse whose spirit I have been attempting to describe is only at the beginning of its work. When the new aspirations in education, which are now called manual training, come to a fuller development, they will concern themselves not with the hand only, but with the entire body and the entire being. We even hope that at some time in the future parents and teachers will feel it their duty to acquaint themselves with the condition and needs of the little bodies of which they are now the ignorant guardians, and will attempt by definite means to make them more fitting vestments for the human soul. The time has come, it seems to me, when evolution should be a conscious process, and man should work in happy sympathy with the purposes of that power which makes for righteousness.

Although the most distinctive feature in these schools is naturally the manual department, its success from the educational standpoint can only be judged by observing its effect upon the rest of the school work. It is true that the boy does not in all cases understand the full significance of his work, but he is, nevertheless, gaining unconsciously that degree of patience, of perseverance, and of judgment needed to accomplish his task. The next thing he undertakes demands these qualities in fuller measure, and so the work of character-building goes on simultaneously with the production of handiwork. The boy sees, perhaps, only these finished pieces of work as his result. We who are looking on see something vastly more important. We see the sturdier virtues—self-reliance, manliness, and helpfulness—developing to wholesome proportions. The boy takes pride in his work, and we take pride in him.

The constructive faculty in children and boys is very strong.

They seem never so thoroughly happy as when they are making something. This wonderful self-activity in children was what Froebel seized upon as the basis for the Kindergarten. In boys it is made the basis for manual training. Whenever possible, the appeal is made to their own resources and faculties in preference to the external world. Here, as in the lecture and recitation room, education is made to proceed subjectively.

In judging of the success of the enterprise, due allowance must be made for the quality of the material that is to be worked up. It is to be remembered that not a few of the boys who come to a manual training school come there for the express purpose of cultivating the mechanical side to the exclusion of everything else. In many cases these lads are finally converted to the broader view of life, but, if that enlightenment does not come, they can hardly be taken to represent in fairness either the aim or the result of manual training. Comparisons are always difficult to make successfully, and here particularly so, because allowances have to be made on both sides. While many of the most clever little workmen would possibly count as dullards in a school of different character, not a few of the boys represent an intelligence above the average. For it is the more advanced people who have been the first to recognize the significance of manual training, and have shown their faith in it by selecting it for their own sons. The visitor to a manual training school, if he come to it with the shop idea in his head, expresses constant surprise at the class of boys he sees there. Sometimes he very graciously compliments the institution on its excellent English, under the apparent impression that a little noise has a tendency to make the adverb and the adjective, the past tense and the perfect participle, play at stage-coach and change places with each other. His surprise is perhaps not unnatural, for he comes expecting to find a shop, and he finds a school.

The theory upon which a manual training school is conducted may not be lightly disregarded. It has here been dwelt upon as the all-important thing about the school, for it determines the aims and methods of the institution, and the very atmosphere of its lecture-rooms and laboratories. Moreover, it determines for what class of students the school is intended. If things be regarded as the proper product, only prospective artisans should enroll themselves among its students; but if men be the product sought, then its rolls will be as catholic as human want itself. There, in jackets and knickerbockers, will be found the embryo scientist and teacher, journalist and minister, lawyer and doctor, artist and artisan, merchant and manufacturer; and these men, though they may never have occasion to directly exercise their acquired dexterity, will be brought into fuller relation with all life through

that complete education of the faculties which it is the function of a manual training school to accomplish.

In glancing at the several schools of this character which have been established in America, one must admit that the artisan spirit is more prevalent than the educational. The fact is to be deplored. It means that unless the advocates of the higher position are alert and vigilant, the fine opportunity for broader culture offered by manual training will be lost in mere technique. The man-element will go under, and the world of things will again rule.

The chief claim of manual training, it must be repeated, is not mechanical. It is spiritual, the development of character; and while its success in this direction can not always be judged from the standard of formal scholarship, there are other and very ready tests which are infallible. Conduct is a sure gauge of the stuff of which a boy is made. No better index of the moral atmosphere of a school can be found, I think, than its discipline. The boys in a manual training school are not yet old. The younger among them are only thirteen or fourteen years, and to boys of this age there are special temptations to disorder in the freedom and movement of the laboratories. To maintain order among three hundred of these active young spirits without appealing to their fear of consequences, or to other vicious motives, would not seem an easy task. Yet it is accomplished in a highly satisfactory manner. There are plenty of noise and life, it is true, and a fair share of fun, but this seldom goes beyond wholesome bounds. As far as possible the order of the school is left to the boys themselves. Certain customs are observed as a matter of convenience, but there are no formal rules for conduct. The boys know perfectly well what is right, and they are encouraged to do it because it is the right, and not because they will get into trouble if they do otherwise. As little personal authority is exerted as possible. The inexorable law of right is taught as a principle, to which both teacher and boy must conform. It is a high ground to take, but it works—as all appeals to the better nature of a boy generally do. It is possible that this abnegation of authority robs the professorial chair of some of its dignity, but there are better levers in the world than this. The friendly, even affectionate, comradeship between teacher and pupil which takes its place, is the source of a deeper influence and of a more profitable intercourse.

It is felt by those imbued with the new idea of education that punishment, however judiciously applied, is an inadequate and superficial thing, and represents at best misapplied energy. Nature has placed an indissoluble bond between cause and effect. Wrong conduct is so surely followed by natural punishment that it seems a presumption on the part of a teacher to attempt to

measure out a suitable penalty in addition. The same effort can better be applied to an attempt to show the boy why a certain line of conduct is wrong, and the greater beauty of the right. All appeals are avoided which involve in any way the fear of consequences. This applies not only to the discipline of the school but also to questions of scholarship. The system of daily marking has been abolished, and an attempt made to substitute the natural and proper motive for study in place of the lower and artificial one. No rod, either mental or physical, is held over the boy. Solomon was the great advocate of that system of government, but, judging from the subsequent behavior of Rehoboam, it has been suggested that it was not a success even in the hands of so wise a man. The school is to prepare for life, and in life things are not conducted in that way. The difficult art of governing one's self can best be learned if the practice begins in boyhood. It becomes increasingly difficult to choose the wrong as one recognizes more and more clearly that the offense is primarily against one's own nature, and can meet forgiveness only by self-atonement. The deepest philosophy of life thus forms an essential part of the curriculum of a manual training school. I do not believe that a school conducted in this spirit ever graduates a boy who feels that he is escaping from restraint when he leaves the school. He is under the eye of an ever-present master, who judges with increasing culture, not according to appearance, but righteous judgment; for that master, if the school has been successful, is himself. We feel justified in subordinating the less serious ends of education to this one supreme end; for conduct, as Matthew Arnold says, is at least three fourths of life. It is the essence of religion, the material of men.

In thus seeking to reach the inner sources of conduct and achievement, the manual training school renders an inestimable service if it succeed in arousing boys to think for themselves, and in making them the guardians of their own destiny, working under divine law. But the work of the school does not end here. The occupations of life which open before its graduates are varied and numerous. There is something for all talents, however diverse. A school which produces men must so train its boys that they will be competent to take some definite and acceptable part in this complex activity. The selection of the right part to be taken is a matter of no small moment. It must be made ultimately by the boy himself, but he is as yet so young and so inexperienced, it is no wonder that many men declare in after-life that they have mistaken their vocation. Unless his genius be of the pronounced type which knows its future from the very cradle, this selection, all-important as it is, is extremely difficult to make. The boy needs help and friendly counsel. To prevent the enor-

mous waste of energy and the life-long unhappiness which arise from mistakes in one's calling, is certainly a highly important function of an institution which professes to prepare a lad for the problems of daily living. The absence of pronounced taste in the boy is not the only obstacle to be overcome. There are few boys totally devoid of some interest which may be made available for future work, but it needs something to bring it out. The ordinary school training does not do it. In the outcry which is periodically made against what is mistakenly called "over-education," there is discernible the bitter tone of men who feel in a blind way that somehow the schools have cheated them in so ill-preparing them for life. There is much reason in their complaint. It is not true that such questions are outside the business of the school. What a boy is to do after he leaves school is very much the business of the school, and its neglect is scarcely less than criminal. If what is done before graduation bears no relation to what is to be done after graduation, then the school—and it is said in all soberness—had better give place to the gymnasium, for that at least would give health and beauty in place of narrow chests and pseudo-culture. But the faculty of a manual training school do not so believe. They believe that the development of a useful, judiciously chosen purpose in life is a very important element in education, and it receives in such schools an amount of attention commensurate with its importance. A boy can not judge rightly for what sort of work he is best fitted unless his experience be so enlarged by those who guide his course that he shall at least come in contact with the different departments of human activity, and taste them, if we may so phrase it, for himself. Even with these advantages, the choice is a difficult one. The first boyish impulse is not always to be trusted; but, by giving these impulses as free play as practicable during the three years of the course, the chances of mistake are at least greatly reduced. In a well-equipped manual training school there are few boys who are not able to become interested and proficient in some one of its several departments. In the hope of making the school still more useful in helping boys to select a suitable life-work, and in helping to prepare them to carry it out with efficiency, the plan of post-graduate study has been introduced. By permitting a boy to work a year in that particular department where his undergraduate performances have shown the greatest promise, he can be still more effectively prepared for the work of the world. This is a special and experimental feature of the school at Philadelphia. The results indicate that it is worthy of further extension.

It is significant of the spirit of its teaching that so large a proportion of manual-training graduates continue their studies in

universities and higher technical schools. Its effect, as far as one can judge, has been to make boys aspire after the better things of life.

I have read that Pestalozzi, in his eager enthusiasm, used to find many things in his little school which less partial though not less careful observers failed to discover. I should be sorry to repeat his mistake in connection with the manual training school. I have tried, therefore, to so temper my praise with criticism that both the beauty of the system and its danger should be fairly represented. The view taken might still be too favorable, if it were given as the veritable history of a single school. The spirit of manual training, to which I have tried to give expression, represents rather an ideal, which in moments of extreme hopefulness we are tempted to believe that we have partially realized, and in moments of discouragement we still hold to be worthy of our effort.

AGNOSTICISM AND CHRISTIANITY.

By Prof. T. H. HUXLEY, F. R. S.

Nemo ergo ex me scire quærat, quod me nescire scio, nisi forte ut nescire discat.*
AUGUSTINUS, *De Civ. Dei*, xii, 7.

CONTROVERSY, like most things in this world, has a good and a bad side. On the good side, it may be said that it stimulates the wits, tends to clear the mind, and often helps those engaged in it to get a better grasp of their subject than they had before; while, mankind being essentially fighting animals, a contest leads the public to interest themselves in questions to which, otherwise, they would give but a languid attention. On the bad side, controversy is rarely found to sweeten the temper, and generally tends to degenerate into an exchange of more or less effective sarcasms. Moreover, if it is long continued, the original and really important issues are apt to become obscured by disputes on the collateral and relatively insignificant questions which have cropped up in the course of the discussion. No doubt both of these aspects of controversy have manifested themselves in the course of the debate which has been in progress, for some months, in these pages. So far as I may have illustrated the second, I express repentance and desire absolution; and I shall endeavor to make amends for any foregone lapses by an endeavor to exhibit only the better phase in these concluding remarks.

* Let no one therefore seek to know from me what I know I do not know, except in order to learn not to know.

The present discussion has arisen out of the use, which has become general in the last few years, of the terms "agnostic" and "agnosticism."

The people who call themselves "agnostics" have been charged with doing so because they have not the courage to declare themselves "infidels." It has been insinuated that they have adopted a new name in order to escape the unpleasantness which attaches to their proper denomination. To this wholly erroneous imputation, I have replied by showing that the term "agnostic" did, as a matter of fact, arise in a manner which negatives it; and my statement has not been, and can not be, refuted. Moreover, speaking for myself, and without impugning the right of any other person to use the term in another sense, I further say that agnosticism is not properly described as a "negative" creed, nor indeed as a creed of any kind, except in so far as it expresses absolute faith in the validity of a principle which is as much ethical as intellectual. This principle may be stated in various ways, but they all amount to this: that it is wrong for a man to say that he is certain of the objective truth of any proposition unless he can produce evidence which logically justifies that certainty. This is what agnosticism asserts; and, in my opinion, it is all that is essential to agnosticism. That which agnostics deny and repudiate as immoral is the contrary doctrine, that there are propositions which men ought to believe, without logically satisfactory evidence; and that reprobation ought to attach to the profession of disbelief in such inadequately supported propositions. The justification of the agnostic principle lies in the success which follows upon its application, whether in the field of natural or in that of civil history; and in the fact that, so far as these topics are concerned, no sane man thinks of denying its validity.

Still speaking for myself, I add that, though agnosticism is not, and can not be, a creed, except in so far as its general principle is concerned; yet that the application of that principle results in the denial of, or the suspension of judgment concerning, a number of propositions respecting which our contemporary ecclesiastical "gnostics" profess entire certainty. And in so far as these ecclesiastical persons can be justified in the old-established custom (which many nowadays think more honored in the breach than the observance) of using opprobrious names to those who differ from them, I fully admit their right to call me and those who think with me "infidels"; all I have ventured to urge is that they must not expect us to speak of ourselves by that title.

The extent of the region of the uncertain, the number of the problems the investigation of which ends in a verdict of not

proven, will vary according to the knowledge and the intellectual habits of the individual agnostic. I do not very much care to speak of anything as unknowable. What I am sure about is that there are many topics about which I know nothing, and which, so far as I can see, are out of reach of my faculties. But whether these things are knowable by any one else is exactly one of those matters which is beyond my knowledge, though I may have a tolerably strong opinion as to the probabilities of the case. Relatively to myself, I am quite sure that the region of uncertainty—the nebulous country in which words play the part of realities—is far more extensive than I could wish. Materialism and idealism; theism and atheism; the doctrine of the soul and its mortality or immortality—appear in the history of philosophy like the shades of Scandinavian heroes, eternally slaying one another and eternally coming to life again in a metaphysical "Nifelheim." It is getting on for twenty-five centuries, at least, since mankind began seriously to give their minds to these topics. Generation after generation, philosophy has been doomed to roll the stone up hill; and, just as all the world swore it was at the top, down it has rolled to the bottom again. All this is written in innumerable books; and he who will toil through them will discover that the stone is just where it was when the work began. Hume saw this; Kant saw it; since their time, more and more eyes have been cleansed of the films which prevented them from seeing it; until now the weight and number of those who refuse to be the prey of verbal mystification has begun to tell in practical life.

It was inevitable that a conflict should arise between agnosticism and theology; or rather I ought to say between agnosticism and ecclesiasticism. For theology, the science, is one thing; and ecclesiasticism, the championship of a foregone conclusion * as to the truth of a particular form of theology, is another. With scientific theology, agnosticism has no quarrel. On the contrary, the agnostic, knowing too well the influence of prejudice and idiosyncrasy, even on those who desire most earnestly to be impartial, can wish for nothing more urgently than that the scientific theologian should not only be at perfect liberty to thrash out the matter in his own fashion, but that he should, if he can, find flaws in the agnostic position, and, even if demonstration is not to be had, that he should put, in their full force, the grounds of the conclusions he thinks probable. The scientific theologian admits the agnostic principle, however widely his results may differ from those reached by the majority of agnostics.

But, as between agnosticism and ecclesiasticism, or, as our

* "Let us maintain, before we have proved. This seeming paradox is the secret of happiness." (Dr. Newman, "Tract 85," p. 85.)

neighbors across the Channel call it, clericalism, there can be neither peace nor truce. The cleric asserts that it is morally wrong not to believe certain propositions, whatever the results of a strict scientific investigation of the evidence of these propositions. He tells us that "religious error is, in itself, of an immoral nature."* He declares that he has prejudged certain conclusions, and looks upon those who show cause for arrest of judgment as emissaries of Satan. It necessarily follows that, for him. the attainment of faith, not the ascertainment of truth, is the highest aim of mental life. And, on careful analysis of the nature of this faith, it will too often be found to be not the mystic process of unity with the divine, understood by the religious enthusiast—but that which the candid simplicity of a Sunday scholar once defined it to be. "Faith," said this unconscious plagiarist of Tertullian, "is the power of saying you believe things which are incredible."

Now I, and many other agnostics, believe that faith, in this sense, is an abomination; and though we do not indulge in the luxury of self-righteousness so far as to call those who are not of our way of thinking hard names, we do feel that the disagreement between ourselves and those who hold this doctrine is even more moral than intellectual. It is desirable there should be an end of any mistakes on this topic. If our clerical opponents were clearly aware of the real state of the case, there would be an end of the curious delusion, which often appears between the lines of their writings, that those whom they are so fond of calling "infidels" are people who not only ought to be, but in their hearts are, ashamed of themselves. It would be discourteous to do more than hint the antipodal opposition of this pleasant dream of theirs to facts.

The clerics and their lay allies commonly tell us that, if we refuse to admit that there is good ground for expressing definite convictions about certain topics, the bonds of human society will dissolve and mankind lapse into savagery. There are several answers to this assertion. One is, that the bonds of human society were formed without the aid of their theology, and in the opinion of not a few competent judges have been weakened rather than strengthened by a good deal of it. Greek science, Greek art, the ethics of old Israel, the social organization of old Rome, contrived to come into being without the help of any one who believed in a single distinctive article of the simplest of the Christian creeds. The science, the art, the jurisprudence, the chief political and social theories of the modern world have grown out of those of Greece and Rome—not by favor of, but in the teeth of, the fundamental teachings of early Christianity, to

* Dr. Newman, "Essay on Development," p. 357.

which science, art, and any serious occupation with the things of this world were alike despicable.

Again, all that is best in the ethics of the modern world, in so far as it has not grown out of Greek thought or barbarian manhood, is the direct development of the ethics of old Israel. There is no code of legislation, ancient or modern, at once so just and so merciful, so tender to the weak and poor, as the Jewish law; and if the Gospels are to be trusted, Jesus of Nazareth himself declared that he taught nothing but that which lay implicitly, or explicitly, in the religious and ethical system of his people.

> And the scribe said unto him, Of a truth, Teacher, thou hast well said that he is one; and there is none other but he: and to love him with all the heart, and with all the understanding, and with all the strength, and to love his neighbor as himself, is much more than all whole burnt-offerings and sacrifices. (Mark xii, 32, 33.)

Here is the briefest of summaries of the teaching of the prophets of Israel of the eighth century; does the Teacher, whose doctrine is thus set forth in his presence, repudiate the exposition? Nay, we are told, on the contrary, that Jesus saw that he "answered discreetly," and replied, "Thou art not far from the kingdom of God."

So that I think that even if the creeds, from the so-called "Apostles'" to the so-called "Athanasian," were swept into oblivion; and even if the human race should arrive at the conclusion that whether a bishop washes a cup or leaves it unwashed, is not a matter of the least consequence, it will get on very well. The causes which have led to the development of morality in mankind, which have guided or impelled us all the way from the savage to the civilized state, will not cease to operate because a number of ecclesiastical hypotheses turn out to be baseless. And, even if the absurd notion that morality is more the child of speculation than of practical necessity and inherited instinct, had any foundation; if all the world is going to thieve, murder, and otherwise misconduct itself as soon as it discovers that certain portions of ancient history are mythical, what is the relevance of such arguments to any one who holds by the agnostic principle?

Surely the attempt to cast out Beelzebub by the aid of Beelzebub is a hopeful procedure as compared to that of preserving morality by the aid of immorality. For I suppose it is admitted that an agnostic may be perfectly sincere, may be competent, and may have studied the question at issue with as much care as his clerical opponents. But, if the agnostic really believes what he says, the "dreadful consequence" argufier (consistently I admit with his own principles) virtually asks him to abstain from tell-

ing the truth, or to say what he believes to be untrue, because of the supposed injurious consequences to morality. "Beloved brethren, that we may be spotlessly moral, before all things let us lie," is the sum total of many an exhortation addressed to the "infidel." Now, as I have already pointed out, we can not oblige our exhorters. We leave the practical application of the convenient doctrines of "reserve" and "non-natural interpretation" to those who invented them.

I trust that I have now made amends for any ambiguity, or want of fullness, in my previous exposition of that which I hold to be the essence of the agnostic doctrine. Henceforward, I might hope to hear no more of the assertion that we are necessarily materialists, idealists, atheists, theists, or any other *ists*, if experience had led me to think that the proved falsity of a statement was any guarantee against its repetition. And those who appreciate the nature of our position will see, at once, that when ecclesiasticism declares that we ought to believe this, that, and the other, and are very wicked if we don't, it is impossible for us to give any answer but this: We have not the slightest objection to believe anything you like, if you will give us good grounds for belief; but, if you can not, we must respectfully refuse, even if that refusal should wreck morality and insure our own damnation several times over. We are quite content to leave that to the decision of the future. The course of the past has impressed us with the firm conviction that no good ever comes of falsehood, and we feel warranted in refusing even to experiment in that direction.

In the course of the present discussion it has been asserted that the "Sermon on the Mount" and the "Lord's Prayer" furnish a summary and condensed view of the essentials of the teaching of Jesus of Nazareth, set forth by himself. Now this supposed *Summa* of Nazarene theology distinctly affirms the existence of a spiritual world, of a heaven, and of a hell of fire; it teaches the fatherhood of God and the malignity of the devil; it declares the superintending providence of the former and our need of deliverance from the machinations of the latter; it affirms the fact of demoniac possession and the power of casting out devils by the faithful. And, from these premises, the conclusion is drawn that those agnostics who deny that there is any evidence of such a character as to justify certainty, respecting the existence and the nature of the spiritual world, contradict the express declarations of Jesus. I have replied to this argumentation by showing that there is strong reason to doubt the historical accuracy of the attribution to Jesus of either the "Sermon on the Mount" or the "Lord's Prayer"; and, therefore, that the conclusion in question is not warranted, at any rate on the grounds set forth.

But, whether the Gospels contain trustworthy statements about this and other alleged historical facts or not, it is quite certain that from them, taken together with the other books of the New Testament, we may collect a pretty complete exposition of that theory of the spiritual world which was held by both Nazarenes and Christians; and which was undoubtedly supposed by them to be fully sanctioned by Jesus, though it is just as clear that they did not imagine it contained any revelation by him of something heretofore unknown. If the pneumatological doctrine which pervades the whole New Testament is nowhere systematically stated, it is everywhere assumed. The writers of the Gospels and of the Acts take it for granted, as a matter of common knowledge; and it is easy to gather from these sources a series of propositions, which only need arrangement to form a complete system.

In this system, man is considered to be a duality formed of a spiritual element, the soul; and a corporeal* element, the body And this duality is repeated in the universe, which consists of a corporeal world embraced and interpenetrated by a spiritual world. The former consists of the earth, as its principal and central constituent, with the subsidiary sun, planets, and stars. Above the earth is the air, and below it the watery abyss. Whether the heaven, which is conceived to be above the air, and the hell in, or below, the subterranean deeps, are to be taken as corporeal or incorporeal is not clear.

However this may be, the heaven and the air, the earth and the abyss, are peopled by innumerable beings analogous in nature to the spiritual element in man, and these spirits are of two kinds, good and bad. The chief of the good spirits, infinitely superior to all the others, and their Creator as well as the Creator of the corporeal world and of the bad spirits, is God. His residence is heaven, where he is surrounded by the ordered hosts of good spirits; his angels, or messengers, and the executors of his will throughout the universe.

On the other hand, the chief of the bad spirits is Satan—*the* devil *par excellence*. He and his company of demons are free to roam through all parts of the universe, except heaven. These bad spirits are far superior to man in power and subtlety, and their whole energies are devoted to bringing physical and moral evils upon him, and to thwarting, so far as their power goes, the benevolent intentions of the Supreme Being. In fact, the souls and bodies of men form both the theatre and the prize of an incessant warfare between the good and the evil spirits—the powers of light and the powers of darkness. By leading Eve astray, Satan brought sin and death upon mankind. As the gods of the hea-

* It is by no means to be assumed that "spiritual" and "corporeal" are exact equivalents of "immaterial" and "material" in the minds of ancient speculators on these topics.

then, the demons are the founders and maintainers of idolatry; as the "powers of the air," they afflict mankind with pestilence and famine; as "unclean spirits," they cause disease of mind and body.

The significance of the appearance of Jesus, as the Messiah or Christ, is the reversal of the satanic work, by putting an end to both sin and death. He announces that the kingdom of God is at hand, when the "prince of this world" shall be finally "cast out" (John xii, 31) from the cosmos, as Jesus, during his earthly career, cast him out from individuals. Then will Satan and all his deviltry, along with the wicked whom they have seduced to their destruction, be hurled into the abyss of unquenchable fire—there to endure continual torture, without a hope of winning pardon from the merciful God, their Father; or of moving the glorified Messiah to one more act of pitiful intercession; or even of interrupting, by a momentary sympathy with their wretchedness, the harmonious psalmody of their brother angels and men, eternally lapped in bliss unspeakable.

The straitest Protestant, who refuses to admit the existence of any source of divine truth, except the Bible, will not deny that every point of the pneumatological theory here set forth has ample scriptural warranty: the Gospels, the Acts, the Epistles, and the Apocalypse assert the existence of the devil and his demons and hell, as plainly as they do that of God and his angels and heaven. It is plain that the Messianic and the satanic conceptions of the writers of these books are the obverse and the reverse of the same intellectual coinage. If we turn from Scripture to the traditions of the fathers and the confessions of the churches, it will appear that in this one particular, at any rate, time has brought about no important deviation from primitive belief. From Justin onward, it may often be a fair question whether God, or the devil, occupies a larger share of the attention of the fathers. It is the devil who instigates the Roman authorities to persecute; the gods and goddesses of paganism are devils, and idolatry itself is an invention of Satan; if a saint falls away from grace, it is by the seduction of the demon; if a heresy arises, the devil has suggested it; and some of the fathers * go so far as to challenge the pagans to a sort of exorcising match, by way of testing the truth of Christianity. Mediæval Christianity is at one with patristic, on this head. The masses, the clergy, the theologians, and the philosophers alike, live and move and have their being in a world full of demons, in which sorcery and possession are

* Tertullian ("Apolog. adv. Gentes," cap. xxiii) thus challenges the Roman authorities: let them bring a possessed person into the presence of a Christian before their tribunal; and, if the demon does not confess himself to be such, on the order of the Christian, let the Christian be executed out of hand.

every-day occurrences. Nor did the Reformation make any difference. Whatever else Luther assailed, he left the traditional demonology untouched; nor could any one have entertained a more hearty and uncompromising belief in the devil, than he and, at a later period, the Calvinistic fanatics of New England did. Finally, in these last years of the nineteenth century, the demonological hypotheses of the first century are, explicitly or implicitly, held and occasionally acted upon, by the immense majority of Christians of all confessions.

Only here and there has the progress of scientific thought, outside the ecclesiastical world, so far affected Christians that they and their teachers fight shy of the demonology of their creed. They are fain to conceal their real disbelief in one half of Christian doctrine by judicious silence about it; or by flight to those refuges for the logically destitute, accommodation or allegory. But the faithful who fly to allegory in order to escape absurdity resemble nothing so much as the sheep in the fable who—to save their lives—jumped into the pit. The allegory pit is too commodious, is ready to swallow up so much more than one wants to put into it. If the story of the temptation is an allegory; if the early recognition of Jesus as the Son of God by the demons is an allegory; if the plain declaration of the writer of the first Epistle of John (iii, 8), "To this end was the Son of God manifested that he might destroy the works of the devil," is allegorical, then the Pauline verson of the fall may be allegorical, and still more the words of consecration of the Eucharist, or the promise of the second coming; in fact, there is not a dogma of ecclesiastical Christianity the scriptural basis of which may not be whittled away by a similar process.

As to accommodation, let any honest man who can read the New Testament ask himself whether Jesus and his immediate friends and disciples can be dishonored more grossly than by the supposition that they said and did that which is attributed to them; while, in reality, they disbelieved in Satan and his demons, in possession and in exorcism?*

An eminent theologian has justly observed that we have no right to look at the propositions of the Christian faith with one eye open and the other shut. ("Tract 85," p. 29.) It really is not permissible to see with one eye, that Jesus is affirmed to declare the personality and the fatherhood of God, his loving providence, and his accessibility to prayer, and to shut the other to the no less definite teaching ascribed to Jesus in regard to the personality and the misanthropy of the devil, his malignant watchfulness,

* See the expression of orthodox opinion upon the "accommodation" subterfuge, already cited, "Nineteenth Century," February, 1889, p. 173; "Popular Science Monthly," April, 1889, p. 754.

and his subjection to exorcistic formulæ and rites. Jesus is made to say that the devil "was a murderer from the beginning" (John viii, 44) by the same authority as that upon which we depend for his asserted declaration that "God is a spirit" (John iv, 24).

To those who admit the authority of the famous Vincentian dictum that the doctrine which has been held "always, everywhere, and by all" is to be received as authoritative, the demonology must possess a higher sanction than any other Christian dogma, except, perhaps, those of the resurrection and of the Messiahship of Jesus; for it would be difficult to name any other points of doctrine on which the Nazarene does not differ from the Christian, and the different historical stages and contemporary subdivisions of Christianity from one another. And, if the demonology is accepted, there can be no reason for rejecting all those miracles in which demons play a part. The Gadarene story fits into the general scheme of Christianity, and the evidence for "Legion" and their doings is just as good as any other in the New Testament for the doctrine which the story illustrates.

It was with the purpose of bringing this great fact into prominence, of getting people to open both their eyes when they look at ecclesiasticism, that I devoted so much space to that miraculous story which happens to be one of the best types of its class. And I could not wish for a better justification of the course I have adopted than the fact that my heroically consistent adversary has declared his implicit belief in the Gadarene story and (by necessary consequence) in the Christian demonology as a whole. It must be obvious, by this time, that, if the account of the spiritual world given in the New Testament, professedly on the authority of Jesus, is true, then the demonological half of that account must be just as true as the other half. And, therefore, those who question the demonology, or try to explain it away, deny the truth of what Jesus said, and are, in ecclesiastical terminology, "infidels" just as much as those who deny the spirituality of God. This is as plain as anything can well be, and the dilemma for my opponent was either to assert that the Gadarene pig-bedevilment actually occurred, or to write himself down an "infidel." As was to be expected, he chose the former alternative; and I may express my great satisfaction at finding that there is one spot of common ground on which both he and I stand. So far as I can judge, we are agreed to state one of the broad issues between the consequences of agnostic principles (as I draw them), and the consequences of ecclesiastical dogmatism (as he accepts it), as follows:

Ecclesiasticism says: The demonology of the Gospels is an essential part of that account of that spiritual world, the truth of which it declares to be certified by Jesus.

Agnosticism (*me judice*) says: There is no good evidence of the existence of a demonic spiritual world, and much reason for doubting it.

Hereupon the ecclesiastic may observe: Your doubt means that you disbelieve Jesus; therefore you are an "infidel" instead of an "agnostic." To which the agnostic may reply: No; for two reasons: first, because your evidence that Jesus said what you say he said is worth very little; and, secondly, because a man may be an agnostic in the sense of admitting he has no positive knowledge; and yet consider that he has more or less probable ground for accepting any given hypothesis about the spiritual world. Just as a man may frankly declare that he has no means of knowing whether the planets generally are inhabited or not, and yet may think one of the two possible hypotheses more likely than the other, so he may admit that he has no means of knowing anything about the spiritual world, and yet may think one or other of the current views on the subject, to some extent, probable.

The second answer is so obviously valid that it needs no discussion. I draw attention to it simply in justice to those agnostics, who may attach greater value than I do to any sort of pneumatological speculations, and not because I wish to escape the responsibility of declaring that, whether Jesus sanctioned the demonological part of Christianity or not, I unhesitatingly reject it. The first answer, on the other hand, opens up the whole question of the claim of the biblical and other sources, from which hypotheses concerning the spiritual world are derived, to be regarded as unimpeachable historical evidence as to matters of fact.

Now, in respect of the trustworthiness of the Gospel narratives, I was anxious to get rid of the common assumption that the determination of the authorship and of the dates of these works is a matter of fundamental importance. That assumption is based upon the notion that what contemporary witnesses say must be true, or, at least, has always a *prima facie* claim to be so regarded; so that if the writers of any of the Gospels were contemporaries of the events (and still more if they were in the position of eye-witnesses) the miracles they narrate must be historically true, and, consequently, the demonology which they involve must be accepted. But the story of the "Translation of the Blessed Martyrs Marcellinus and Petrus," and the other considerations (to which endless additions might have been made from the fathers and the mediæval writers) set forth in this review for March last, yield, in my judgment, satisfactory proof that, where the miraculous is concerned, neither considerable intellectual ability, nor undoubted honesty, nor knowledge of the world, nor proved faithfulness as civil historians, nor profound piety, on the part of eye-

witnesses and contemporaries, affords any guarantee of the objective truth of their statements, when we know that a firm belief in the miraculous was ingrained in their minds, and was the presupposition of their observations and reasonings.

Therefore, although it be, as I believe, demonstrable that we have no real knowledge of the authorship, or of the date of composition of the Gospels, as they have come down to us, and that nothing better than more or less probable guesses can be arrived at on that subject, I have not cared to expend any space on the question. It will be admitted, I suppose, that the authors of the works attributed to Matthew, Mark, Luke, and John, whoever they may be, are personages whose capacity and judgment in the narration of ordinary events are not quite so well certified as those of Eginhard; and we have seen what the value of Eginhard's evidence is when the miraculous is in question.

I have been careful to explain that the arguments which I have used in the course of this discussion are not new; that they are historical and have nothing to do with what is commonly called science; and that they are all, to the best of my belief, to be found in the works of theologians of repute.

The position which I have taken up, that the evidence in favor of such miracles as those recorded by Eginhard, and consequently of mediæval demonology, is quite as good as that in favor of such miracles as the Gadarene, and consequently of Nazarene demonology, is none of my discovery. Its strength was, wittingly or unwittingly, suggested, a century and a half ago, by a theological scholar of eminence; and it has been, if not exactly occupied, yet so fortified with bastions and redoubts by a living ecclesiastical Vauban, that, in my judgment, it has been rendered impregnable. In the early part of the last century, the ecclesiastical mind in this country was much exercised by the question, not exactly of miracles, the occurrence of which in biblical times was axiomatic, but by the problem, When did miracles cease? Anglican divines were quite sure that no miracles had happened in their day, nor for some time past; they were equally sure that they happened sixteen or seventeen centuries earlier. And it was a vital question for them to determine at what point of time, between this *terminus a quo* and that *terminus ad quem*, miracles came to an end.

The Anglicans and the Romanists agreed in the assumption that the possession of the gift of miracle-working was *prima facie* evidence of the soundness of the faith of the miracle-workers. The supposition that miraculous powers might be wielded by heretics (though it might be supported by high authority) led to consequences too frightful to be entertained by people who were

busied in building their dogmatic house on the sands of early church history. If, as the Romanists maintained, an unbroken series of genuine miracles adorned the records of their Church, throughout the whole of its existence, no Anglican could lightly venture to accuse them of doctrinal corruption. Hence, the Anglicans, who indulged in such accusations, were bound to prove the modern, the mediæval Roman, and the later patristic miracles false; and to shut off the wonder-working power from the Church at the exact point of time when Anglican doctrine ceased and Roman doctrine began. With a little adjustment—a squeeze here and a pull there—the Christianity of the first three or four centuries might be made to fit, or seem to fit, pretty well into the Anglican scheme. So the miracles, from Justin say to Jerome, might be recognized; while, in later times, the Church having become "corrupt"—that is to say, having pursued one and the same line of development further than was pleasing to Anglicans—its alleged miracles must needs be shams and impostures.

Under these circumstances, it may be imagined that the establishment of a scientific frontier, between the earlier realm of supposed fact and the later of asserted delusion, had its difficulties; and torrents of theological special pleading about the subject flowed from clerical pens; until that learned and acute Anglican divine, Conyers Middleton, in his "Free Inquiry," tore the sophistical web they had laboriously woven to pieces, and demonstrated that the miracles of the patristic age, early and late, must stand or fall together, inasmuch as the evidence for the later is just as good as the evidence for the earlier wonders. If the one set are certified by contemporaneous witnesses of high repute, so are the other; and, in point of probability, there is not a pin to choose between the two. That is the solid and irrefragable result of Middleton's contribution to the subject. But the Free Inquirer's freedom had its limits; and he draws a sharp line of demarkation between the patristic and the New Testament miracles—on the professed ground that the accounts of the latter, being inspired, are out of the reach of criticism.

A century later, the question was taken up by another divine, Middleton's equal in learning and acuteness, and far his superior in subtlety and dialectic skill; who, though an Anglican, scorned the name of Protestant; and, while yet a Churchman, made it his business to parade, with infinite skill, the utter hollowness of the arguments of those of his brother Churchmen who dreamed that they could be both Anglicans and Protestants. The argument of the "Essay on the Miracles recorded in the Ecclesiastical History of the Early Ages,"* by the present Roman cardinal, but then

* I quote the first edition (1843). A second edition appeared in 1870. Tract 85 of the "Tracts for the Times" should be read with this "Essay." If I were called upon to

Anglican doctor, John Henry Newman, is compendiously stated by himself in the following passage:

> If the miracles of church history can not be defended by the arguments of Leslie, Lyttleton, Paley, or Douglas, how many of the Scripture miracles satisfy their conditions? (p. cvii).

And, although the answer is not given in so many words, little doubt is left on the mind of the reader that in the mind of the writer it is: None. In fact, this conclusion is one which can not be resisted, if the argument in favor of the Scripture miracles is based upon that which laymen, whether lawyers, or men of science, or historians, or ordinary men of affairs, call evidence. But there is something really impressive in the magnificent contempt with which, at times, Dr. Newman sweeps aside alike those who offer and those who demand such evidence.

> Some infidel authors advise us to accept no miracles which would not have a verdict in their favor in a court of justice; that is, they employ against Scripture a weapon which Protestants would confine to attacks upon the Church, as if moral and religious questions required legal proofs, and evidence were the test of truth* (p. cvii).

"As if evidence were the test of truth"!—although the truth in question is the occurrence or non-occurrence of certain phenomena at a certain time and in a certain place. This sudden revelation of the great gulf fixed between the ecclesiastical and the scientific mind is enough to take away the breath of any one unfamiliar with the clerical organon. As if, one may retort, the assumption that miracles may, or have, served a moral or a religious end in any way alters the fact that they profess to be historical events, things that actually happened; and, as such, must needs be exactly those subjects about which evidence is appropriate and legal proofs (which are such merely because they afford adequate evidence) may be justly demanded. The Gadarene miracle either happened, or it did not. Whether the Gadarene "question" is moral or religious, or not, has nothing to do with the fact that it is a purely historical question whether the demons said what they are declared to have said, and the devil-possessed pigs did or did not rush over the cliffs of the Lake of Gennesareth on a certain day of a certain year, after A. D. 26 and before A. D. 36; for, vague and uncertain as New Testament chronology is, I suppose it may be assumed that the event in question, if it happened at all, took place during the procuratorship of Pilate.

compile a primer of "infidelity," I think I should save myself trouble by making a selection from these works, and from the "Essay on Development" by the same author.

* Yet, when it suits his purpose, as in the introduction to the "Essay on Development," Dr. Newman can demand strict evidence in religious questions as sharply as any "infidel author"; and he can even profess to yield to its force ("Essays on Miracles," 1870, note, p. 391).

If that is not a matter about which evidence ought to be required, and not only legal but strict scientific proof demanded by sane men who are asked to believe the story—what is? Is a reasonable being to be seriously asked to credit statements which, to put the case gently, are not exactly probable, and on the acceptance or rejection of which his whole view of life may depend, without asking for as much "legal" proof as would send an alleged pickpocket to jail, or as would suffice to prove the validity of a disputed will?

"Infidel authors" (if, as I am assured, I may answer for them) will decline to waste time on mere darkenings of counsel of this sort; but to those Anglicans who accept his premises, Dr. Newman is a truly formidable antagonist. What, indeed, are they to reply when he puts the very pertinent question:

"whether persons who, not merely question, but prejudge the ecclesiastical miracles on the ground of their want of resemblance, whatever that be, to those contained in Scripture—as if the Almighty could not do in the Christian church what he had not already done at the time of its foundation, or under the Mosaic covenant—whether such reasoners are not siding with the skeptic,"

and

"whether it is not a happy inconsistency by which they continue to believe the Scriptures while they reject the Church"* (p. liii).

Again, I invite Anglican orthodoxy to consider this passage:

the narrative of the combats of St. Antony with evil spirits is a development rather than a contradiction of revelation, viz., of such texts as speak of Satan being cast out by prayer and fasting. To be shocked, then, at the miracles of ecclesiastical history, or to ridicule them for their strangeness, is no part of a scriptural philosophy (p. liii–liv).

Further on, Dr. Newman declares that it has been admitted

that a distinct line can be drawn in point of character and circumstance between the miracles of Scripture and of church history; but this is by no means the case (p. lv). . . . Specimens are not wanting in the history of the Church of miracles as awful in their character and as momentous in their effects as those which are recorded in Scripture. The fire interrupting the rebuilding of the Jewish temple, and the death of Arius, are instances in ecclesiastical history of such solemn events. On the other hand, difficult instances in the Scripture history are such as these: the serpent in Eden, the ark, Jacob's vision for the multiplication of his cattle, the speaking of Balaam's ass, the axe swimming at Elisha's word, the miracle on the swine, and various instances of prayers or prophecies, in which, as in that of Noah's blessing and curse, words which seem the result of private feeling are expressly or virtually ascribed to a divine suggestion (p. lvi).

Who is to gainsay our ecclesiastical authority here? "Infidel authors" might be accused of a wish to ridicule the Scripture

* Compare Tract 85, p. 110: "I am persuaded that were men but consistent who oppose the Church doctrines as being unscriptural, they would vindicate the Jews for rejecting the gospel."

miracles by putting them on a level with the remarkable story about the fire which stopped the rebuilding of the temple, or that about the death of Arius—but Dr. Newman is above suspicion. The pity is that his list of what he delicately terms "difficult" instances is so short. Why omit the manufacture of Eve out of Adam's rib, on the strict historical accuracy of which the chief argument of the defenders of an iniquitous portion of our present marriage law depends? Why leave out the account of the "Bene Elohim" and their gallantries, on which a large part of the worst practices of the mediæval inquisitors into witchcraft was based? Why forget the angel who wrestled with Jacob, and, as the account suggests, somewhat overstepped the bounds of fair play at the end of the struggle? Surely we must agree with Dr. Newman that, if all these camels have gone down, it savors of affectation to strain at such gnats as the sudden ailment of Arius in the midst of his deadly, if prayerful,* enemies; and the fiery explosion which stopped the Julian building operations. Though the *words* of the "Conclusion" of the "Essay on Miracles" may, perhaps, be quoted against me, I may express my satisfaction at finding myself in substantial accordance with a theologian above all suspicion of heterodoxy. With all my heart, I can declare my belief that there is just as good reason for believing in the miraculous slaying of the man who fell short of the Athanasian power of affirming contradictories, with respect to the nature of the Godhead, as there is for believing in the stories of the serpent and the ark told in Genesis, the speaking of Balaam's ass in Numbers, or the floating of the axe, at Elisha's order, in the second book of Kings.

It is one of the peculiarities of a really sound argument that it is susceptible of the fullest development; and that it sometimes leads to conclusions unexpected by those who employ it. To my mind it is impossible to refuse to follow Dr. Newman when he extends his reasoning from the miracles of the patristic and mediæval ages backward in time as far as miracles are recorded. But, if the rules of logic are valid, I feel compelled to extend the argument forward to the alleged Roman miracles of the present day, which Dr. Newman might not have admitted.

* According to Dr. Newman, "This prayer [that of Bishop Alexander, who begged God to 'take Arius away'] is said to have been offered about 3 P.M. on the Saturday; that same evening Arius was in the great square of Constantine, when he was suddenly seized with indisposition" (p. clxx). The "infidel" Gibbon seems to have dared to suggest that "an option between poison and miracle" is presented by this case; and it must be admitted, that if the bishop had been within reach of a modern police magistrate, things might have gone hardly with him. Modern "infidels," possessed of a slight knowledge of chemistry, are not unlikely, with no less audacity, to suggest an "option between fire-damp and miracle" in seeking for the cause of the fiery outburst at Jerusalem.

but which Cardinal Newman may hardly reject. Beyond question, there is as good, or perhaps better, evidence for the miracles worked by our Lady of Lourdes, as there is for the floating of Elisha's axe or the speaking of Balaam's ass. But we must go still further; there is a modern system of thaumaturgy and demonology which is just as well certified as the ancient.* Veracious, excellent, sometimes learned and acute persons, even philosophers of no mean pretension, testify to the "levitation" of bodies much heavier than Elisha's axe; to the existence of "spirits" who, to the mere tactile sense, have been indistinguishable from flesh and blood, and occasionally have wrestled with all the vigor of Jacob's opponent; yet, further, to the speech, in the language of raps, of spiritual beings, whose discourses, in point of coherence and value, are far inferior to that of Balaam's humble but sagacious steed. I have not the smallest doubt that, if these were persecuting times, there is many a worthy "spiritualist" who would cheerfully go to the stake in support of his pneumatological faith, and furnish evidence, after Paley's own heart, in proof of the truth of his doctrines. Not a few modern divines, doubtless struck by the impossibility of refusing the spiritualist evidence, if the ecclesiastical evidence is accepted, and deprived of any *a priori* objection by their implicit belief in Christian demonology, show themselves ready to take poor Sludge seriously, and to believe that he is possessed by other devils than those of need, greed, and vainglory.

Under these circumstances, it was to be expected, though it is none the less interesting to note the fact, that the arguments of the latest school of "spiritualists" present a wonderful family likeness to those which adorn the subtle disquisitions of the advocate of ecclesiastical miracles of forty years ago. It is unfortunate for the "spiritualists" that, over and over again, celebrated and trusted media, who really, in some respects, call to mind the

* A writer in a spiritualist journal takes me roundly to task for venturing to doubt the historical and literal truth of the Gadarene story. The following passage in his letter is worth quotation: "Now to the materialistic and scientific mind, to the uninitiated in spiritual verities, certainly this story of the Gadarene or Gergesene swine presents insurmountable difficulties; it seems grotesque and nonsensical. To the experienced, trained, and cultivated Spiritualist this miracle is, as I am prepared to show, one of the most instructive, the most profoundly useful, and the most beneficent which Jesus ever wrought in the whole course of his pilgrimage of redemption on earth." Just so. And the first page of this same journal presents the following advertisement, among others of the same kidney:

"To Wealthy Spiritualists.—A lady medium of tried power wishes to meet with an elderly gentleman who would be willing to give her a comfortable home and maintenance in exchange for her spiritualistic services, as her guides consider her health is too delicate for public sittings: London preferred.—Address 'Mary,' office of 'Light.'"

Are we going back to the days of the Judges, when wealthy Micah set up his private ephod, teraphim, and Levite?

Montanist* and gnostic seers of the second century, are either proved in courts of law to be fraudulent impostors; or, in sheer weariness, as it would seem, of the honest dupes who swear by them, spontaneously confess their long-continued iniquities, as the Fox women did the other day in New York.† But whenever a catastrophe of this kind takes place, the believers are nowise dismayed by it. They freely admit that not only the media, but the spirits whom they summon, are sadly apt to lose sight of the elementary principles of right and wrong; and they triumphantly ask: How does the occurrence of occasional impostures disprove the genuine manifestations (that is to say, all those which have not yet been proved to be impostures or delusions)? And, in this, they unconsciously plagiarize from the churchman, who just as freely admits that many ecclesiastical miracles may have been forged; and asks, with the same calm contempt, not only of legal proofs, but of common-sense probability, Why does it follow that none are to be supposed genuine? I must say, however, that the spiritualists, so far as I know, do not venture to outrage right reason so boldly as the ecclesiastics. They do not sneer at "evidence"; nor repudiate the requirement of legal proofs. In fact, there can be no doubt that the spiritualists produce better evidence for their manifestations than can be shown either for the miraculous death of Arius, or for the invention of the cross.‡

From the "levitation" of the axe at one end of a period of near three thousand years to the "levitation" of Sludge & Co. at the other end, there is a complete continuity of the miraculous with every gradation from the childish to the stupendous, from the gratification of a caprice to the illustration of sublime truth. There is no drawing a line in the series that might be set out of plausibly attested cases of spiritual intervention. If one is true, all may be true; if one is false, all may be false.

This is, to my mind, the inevitable result of that method of

* Consider Tertullian's "sister" ("hodie apud nos"), who conversed with angels, saw and heard mysteries, knew men's thoughts, and prescribed medicine for their bodies ("De Anima," cap. 9). Tertullian tells us that this woman saw the soul as corporeal, and described its color and shape. The "infidel" will probably be unable to refrain from insulting the memory of the ecstatic saint by the remark that Tertullian's known views about the corporeality of the soul may have had something to do with the remarkable perceptive powers of the Montanist medium, in whose revelations of the spiritual world he took such profound interest.

† See the New York "World" for Sunday, October 21, 1888; and the "Report of the Seybert Commission," Philadelphia, 1887.

‡ Dr. Newman's observation that the miraculous multiplication of the pieces of the true cross (with which "the whole world is filled," according to Cyril of Jerusalem; and of which some say there are enough extant to build a man-of-war) is no more wonderful than that of the loaves and fishes, is one that I do not see my way to contradict. See "Essay on Miracles," second edition, p. 163.

reasoning which is applied to the confutation of Protestantism, with so much success, by one of the acutest and subtlest disputants who have ever championed ecclesiasticism—and one can not put his claims to acuteness and subtlety higher.

> . . . the Christianity of history is not Protestantism. If ever there were a safe truth it is this. . . . "To be deep in history is to cease to be a Protestant." *

I have not a shadow of doubt that these anti-Protestant epigrams are profoundly true. But I have as little that, in the same sense, the "Christianity of history is not" Romanism; and that to be deeper in history is to cease to be a Romanist. The reasons which compel my doubts about the compatibility of the Roman doctrine, or any other form of Catholicism, with history, arise out of exactly the same line of argument as that adopted by Dr. Newman in the famous essay which I have just cited. If, with one hand, Dr. Newman has destroyed Protestantism, he has annihilated Romanism with the other; and the total result of his ambidextral efforts is to shake Christianity to its foundations. Nor was any one better aware that this must be the inevitable result of his arguments—if the world should refuse to accept Roman doctrines and Roman miracles—than the writer of Tract 85.

Dr. Newman made his choice and passed over to the Roman Church half a century ago. Some of those who were essentially in harmony with his views preceded, and many followed him. But many remained; and, as the quondam Puseyite and present Ritualistic party, they are continuing that work of sapping and mining the Protestantism of the Anglican Church which he and his friends so ably commenced. At the present time, they have no little claim to be considered victorious all along the line. I am old enough to recollect the small beginnings of the Tractarian party; and I am amazed when I consider the present position of their heirs. Their little leaven has leavened, if not the whole, yet a very large, lump of the Anglican Church; which is now pretty much of a preparatory school for Papistry. So that it really behooves Englishmen (who, as I have been informed by high authority, are all, legally, members of the state Church, if they profess to belong to no other sect) to wake up to what that powerful organization is about, and whither it is tending. On this point, the writings of Dr. Newman, while he still remained within the Anglican fold, are a vast store of the best and the most authoritative information. His doctrines on ecclesiastical miracles and on development are the corner-stones of the Tractarian fabric. He believed that his arguments led either Romeward, or to what ecclesiastics call "infidelity," and I call agnosticism. I believe that

* "An Essay on the Development of Christian Doctrine," by J. H. Newman, D. D., pp. 7 and 8. (1878.)

he was quite right in this conviction; but while he chooses the one alternative, I choose the other; as he rejects Protestantism on the ground of its incompatibility with history, so, *a fortiori*, I conceive that Romanism ought to be rejected, and that an impartial consideration of the evidence must refuse the authority of Jesus to anything more than the Nazarenism of James and Peter and John. And let it not be supposed that this is a mere "infidel" perversion of the facts. No one has more openly and clearly admitted the possibility that they may be fairly interpreted in this way than Dr. Newman. If, he says, there are texts which seem to show that Jesus contemplated the evangelization of the heathen:

> . . . Did not the apostles hear our Lord? and what was *their* impression from what they heard? Is it not certain that the apostles did not gather this truth from his teaching? ("Tract 85," p. 63.)
>
> He said, "Preach the gospel to every creature." These words *need* have only meant "Bring all men to Christianity through Judaism." Make them Jews, that they may enjoy Christ's privileges which are lodged in Judaism; teach them those rites and ceremonies, circumcision and the like, which hitherto have been dead ordinances, and now are living; and so the apostles seem to have understood them (Ibid., p. 65).

So far as Nazarenism differentiated itself from contemporary orthodox Judaism, it seems to have tended toward a revival of the ethical and religious spirit of the prophetic age, accompanied by the belief in Jesus as the Messiah, and by various accretions which had grown round Judaism subsequently to the exile. To these belong the doctrines of the resurrection, of the last judgment, of heaven and hell; of the hierarchy of good angels; of Satan and the hierarchy of evil spirits. And there is very strong ground for believing that all these doctrines, at least in the shapes in which they were held by the post-exilic Jews, were derived from Persian and Babylonian * sources, and are essentially of heathen origin.

How far Jesus positively sanctioned all these indrainings of circumjacent paganism into Judaism; how far any one has a right to say that the refusal to accept one or other of these doctrines as ascertained verities comes to the same thing as contradicting Jesus, it appears to me not easy to say. But it is hardly less difficult to conceive that he could have distinctly negatived any of them; and, more especially, that demonology which has been accepted by the Christian churches in every age and under all their mutual antagonisms. But, I repeat my conviction that,

* Dr. Newman faces this question with his customary ability. "Now, I own, I am not at all solicitous to deny that this doctrine of an apostate angel and his hosts was gained from Babylon: it might still be divine nevertheless. God who made the prophet's ass speak, and thereby instructed the prophet, might instruct his church by means of heathen Babylon" ("Tract 85," p. 83). There seems to be no end to the apologetic burden that Balaam's ass can carry.

whether Jesus sanctioned the demonology of his time and nation or not, it is doomed. The future of Christianity as a dogmatic system and apart from the old Israelitish ethics which it has appropriated and developed, lies in the answer which mankind will eventually give to the question whether they are prepared to believe such stories as the Gadarene and the pneumatological hypotheses which go with it, or not. My belief is they will decline to do anything of the sort, whenever and wherever their minds have been disciplined by science. And that discipline must and will at once follow and lead the footsteps of advancing civilization.

The preceding pages were written before I became acquainted with the contents of the May number of this review, wherein I discover many things which are decidedly not to my advantage. It would appear that "evasion" is my chief resource, "incapacity for strict argument" and "rottenness of ratiocination" my main mental characteristics, and that it is "barely credible" that a statement which I profess to make of my own knowledge is true. All which things I notice, merely to illustrate the great truth, forced on me by long experience, that it is only from those who enjoy the blessing of a firm hold of the Christian faith that such manifestations of meekness, patience, and charity are to be expected.

I had imagined that no one who had read my preceding papers could entertain a doubt as to my position in respect of the main issue as it has been stated and restated by my opponent:

> an agnosticism which knows nothing of the relation of man to God must not only refuse belief to our Lord's most undoubted teaching, but must deny the reality of the spiritual convictions in which he lived and died.*

That is said to be "the simple question which is at issue between us," and the three testimonies to that teaching and those convictions selected are the Sermon on the Mount, the Lord's Prayer, and the Story of the Passion.

My answer, reduced to its briefest form, has been: In the first place, the evidence is such that the exact nature of the teachings and the convictions of Jesus is extremely uncertain, so that what ecclesiastics are pleased to call a denial of them may be nothing of the kind. And, in the second place, if Jesus taught the demonological system involved in the Gadarene story—if a belief in that system formed a part of the spiritual convictions in which he lived and died—then I, for my part, unhesitatingly refuse belief in that teaching, and deny the reality of those spiritual convictions. And I go further and add, that exactly in so far as it

* "Popular Science Monthly," July, 1889, p. 328.

can be proved that Jesus sanctioned the essentially pagan demonological theories current among the Jews of his age, exactly in so far, for me, will his authority in any matter touching the spiritual world be weakened.

With respect to the first half of my answer, I have pointed out that the Sermon on the Mount, as given in the first Gospel, is, in the opinion of the best critics, a "mosaic work" of materials derived from different sources, and I do not understand that this statement is challenged. The only other Gospel, the third, which contains something like it, makes, not only the discourse, but the circumstances under which it was delivered, very different. Now, it is one thing to say that there was something real at the bottom of the two discourses—which is quite possible; and another to affirm that we have any right to say what that something was, or to fix upon any particular phrase and declare it to be a genuine utterance. Those who pursue theology as a science, and bring to the study an adequate knowledge of the ways of ancient historians, will find no difficulty in providing illustrations of my meaning. I may supply one which has come within range of my own limited vision.

In Josephus's "History of the Wars of the Jews" (chap. xix) that writer reports a speech which he says Herod made at the opening of a war with the Arabians. It is in the first person, and would naturally be supposed by the reader to be intended for a true version of what Herod said. In the "Antiquities," written some seventeen years later, the same writer gives another report, also in the first person, of Herod's speech on the same occasion. This second oration is twice as long as the first, and though the general tenor of the two speeches is pretty much the same, there is hardly any verbal identity, and a good deal of matter is introduced into the one which is absent from the other. Now Josephus prides himself on his accuracy; people whose fathers might have heard Herod's oration were his contemporaries; and yet his historical sense is so curiously undeveloped, that he can, quite innocently, perpetrate an obvious literary fabrication; for one of the two accounts must be incorrect. Now, if I am asked whether I believe that Herod made some particular statement on this occasion; whether, for example, he uttered the pious aphorism, "Where God is, there is both multitude and courage," which is given in the "Antiquities," but not in the "Wars," I am compelled to say I do not know. One of the two reports must be erroneous, possibly both are: at any rate, I can not tell how much of either is true. And, if some fervent admirer of the Idumean should build up a theory of Herod's piety upon Josephus's evidence that he propounded the aphorism, is it a "mere evasion" to say, in reply, that the evidence that he did utter it is worthless?

It appears again that, adopting the tactics of Conachar when brought face to face with Hal o' the Wynd, I have been trying to get my simple-minded adversary to follow me on a wild-goose chase through the early history of Christianity, in the hope of escaping impending defeat on the main issue. But I may be permitted to point out that there is an alternative hypothesis which equally fits the facts; and that, after all, there may have been method in the madness of my supposed panic.

For suppose it to be established that Gentile Christianity was a totally different thing from the Nazarenism of Jesus and his immediate disciples; suppose it to be demonstrable that, as early as the sixth decade of our era at least, there were violent divergencies of opinion among the followers of Jesus; suppose it to be hardly doubtful that the Gospels and the Acts took their present shapes under the influence of these divergencies; suppose that their authors, and those through whose hands they passed, had notions of historical veracity not more eccentric than those which Josephus occasionally displays—surely the chances that the Gospels are altogether trustworthy records of the teachings of Jesus become very slender. And as the whole of the case of the other side is based on the supposition that they are accurate records (especially of speeches, about which ancient historians are so curiously loose), I really do venture to submit that this part of my argument bears very seriously on the main issue; and, as ratiocination, is sound to the core.

Again, when I passed by the topic of the speeches of Jesus on the cross, it appears that I could have had no other motive than the dictates of my native evasiveness. An ecclesiastical dignitary may have respectable reasons for declining a fencing-match "in sight of Gethsemane and Calvary"; but an ecclesiastical "infidel"! Never. It is obviously impossible that, in the belief that "the greater includes the less," I, having declared the Gospel evidence in general, as to the sayings of Jesus, to be of questionable value, thought it needless to select, for illustration of my views, those particular instances which were likely to be most offensive to persons of another way of thinking. But any supposition that may have been entertained that the old familiar tones of the ecclesiastical war-drum will tempt me to engage in such needless discussion had better be renounced. I shall do nothing of the kind. Let it suffice that I ask my readers to turn to the twenty-third chapter of Luke (revised version), verse thirty-four, and he will find in the margin

> Some ancient authorities omit: And Jesus said, "Father, forgive them, for they know not what they do."

So that, even as late as the fourth century, there were ancient authorities, indeed some of the most ancient and weightiest, who

either did not know of this utterance, so often quoted as characteristic of Jesus, or did not believe it had been uttered.

Many years ago, I received an anonymous letter, which abused me heartily for my want of moral courage in not speaking out. I thought that one of the oddest charges an anonymous letter-writer could bring. But I am not sure that the plentiful sowing of the pages of the article with which I am dealing with accusations of evasion, may not seem odder to those who consider that the main strength of the answers with which I have been favored (in this review and elsewhere) is devoted not to anything in the text of my first paper, but to a note which occurs at page 171.* In this I say:

> Dr. Wace tells us: "It may be asked how far we can rely on the accounts we possess of our Lord's teaching on these subjects." And he seems to think the question appropriately answered by the assertion that it "ought to be regarded as settled by M. Renan's practical surrender of the adverse case."

I requested Dr. Wace to point out the passages of M. Renan's works in which, as he affirms, this "practical surrender" (not merely as to the age and authorship of the Gospels, be it observed, but as to their historical value) is made, and he has been so good as to do so. Now let us consider the parts of Dr. Wace's citation from Renan which are relevant to the issue:

> The author of this Gospel [Luke] is certainly the same as the author of the Acts of the Apostles. Now the author of the Acts seems to be a companion of St. Paul—a character which accords completely with St. Luke. I know that more than one objection may be opposed to this reasoning; but one thing, at all events, is beyond doubt, namely, that the author of the third Gospel and of the Acts is a man who belonged to the second apostolic generation; and this suffices for our purpose.

This is a curious "practical surrender of the adverse case." M. Renan thinks that there is no doubt that the author of the third Gospel is the author of the Acts—a conclusion in which I suppose critics generally agree. He goes on to remark that this person *seems* to be a companion of St. Paul, and adds that Luke was a companion of St. Paul. Then, somewhat needlessly, M. Renan points out that there is more than one objection to jumping, from such data as these, to the conclusion that "Luke" is the writer of the third Gospel. And, finally, M. Renan is content to reduce that which is "beyond doubt" to the fact that the author of the two books is a man of the second apostolic generation. Well, it seems to me that I could agree with all that M. Renan considers "beyond doubt" here, without surrendering anything, either "practically" or theoretically.

Dr. Wace ("Nineteenth Century," March, p. 363)† states that

* "Popular Science Monthly," April, 1889, p. 752. † Ibid., May, 1889, p. 77.

he derives the above citation from the preface of the fifteenth edition of the "Vie de Jésus." My copy of "Les Evangiles," dated 1877, contains a list of Renan's "Œuvres Complètes," at the head of which I find "Vie de Jésus," 15e édition. It is, therefore, a later work than the edition of the "Vie de Jésus" which Dr. Wace quotes. Now "Les Evangiles," as its name implies, treats fully of the questions respecting the date and authorship of the Gospels; and any one who desired, not merely to use M. Renan's expressions for controversial purposes, but to give a fair account of his views in their full significance, would, I think, refer to the later source.

If this course had been taken, Dr. Wace might have found some as decided expressions of opinion in favor of Luke's authorship of the third Gospel as he has discovered in "The Apostles." I mention this circumstance because I desire to point out that, taking even the strongest of Renan's statements, I am still at a loss to see how it justifies that large-sounding phrase "practical surrender of the adverse case." For, on p. 438 of "Les Evangiles," Renan speaks of the way in which Luke's "excellent intentions" have led him to torture history in the Acts; he declares Luke to be the founder of that "eternal fiction which is called ecclesiastical history"; and, on the preceding page, he talks of the "myth" of the Ascension—with its *mise en scène voulue.* At p. 435, I find "Luc, ou l'auteur quel qu'il soit du troisième Evangile" [Luke, or whoever may be the author of the third Gospel]; at p. 280, the accounts of the Passion, the death and the resurrection of Jesus are said to be "peu historiques" [little historical]; at p. 283, "La valeur historique du troisième Evangile est sûrement moindre que celles des deux premiers" [the historical value of the third Gospel is surely less than that of the first two].

A Pyrrhic sort of victory for orthodoxy this "surrender"! And, all the while, the scientific student of theology knows that the more reason there may be to believe that Luke was the companion of Paul, the more doubtful becomes his credibility, if he really wrote the Acts. For, in that case, he could not fail to have been acquainted with Paul's account of the Jerusalem conference, and he must have consciously misrepresented it. We may next turn to the essential part of Dr. Wace's citation ("Nineteenth Century," p. 365)* touching the first Gospel:

> St. Matthew evidently deserves peculiar confidence for the discourses. Here are "the oracles"—the very notes taken while the memory of the instruction of Jesus was living and definite.

M. Renan here expresses the very general opinion as to the existence of a collection of "logia," having a different origin from

* "Popular Science Monthly," May, 1889, p. 79.

the text in which they are imbedded, in Matthew. "Notes" are somewhat suggestive of a short-hand writer, but the suggestion is unintentional, for M. Renan assumes that these "notes" were taken, not at the time of the delivery of the "logia," but subsequently, while (as he assumes) the memory of them was living and definite; so that, in this very citation, M. Renan leaves open the question of the general historical value of the first Gospel, while it is obvious that the accuracy of "notes," taken, not at the time of delivery, but from memory, is a matter about which more than one opinion may be fairly held. Moreover, Renan expressly calls attention to the difficulty of distinguishing the authentic "logia" from later additions of the same kind ("Les Evangiles," p. 201). The fact is, there is no contradiction here to that opinion about the first Gospel which is expressed in "Les Evangiles" (p. 175).

The text of the so-called Matthew supposes the pre-existence of that of Mark, and does little more than complete it. He completes it in two fashions—first, by the insertion of those long discourses which gave their chief value to the Hebrew Gospels; then by adding traditions of a more modern formation, results of successive developments of the legend, and to which the Christian consciousness already attached infinite value.

M. Renan goes on to suggest that besides "Mark," "pseudo-Matthew" used an Aramaic version of the Gospel originally set forth in that dialect. Finally, as to the second Gospel ("Nineteenth Century," p. 365):*

He [Mark] is full of minute observations, proceeding, beyond doubt, from an eye-witness. There is nothing to conflict with the supposition that this eye-witness . . . was the apostle Peter himself, as Papias has it.

Let us consider this citation also by the light of "Les Evangiles":

This work, although composed after the death of Peter, was, in a sense, the work of Peter; it represents the way in which Peter was accustomed to relate the life of Jesus (p. 116).

M. Renan goes on to say that, as an historical document, the Gospel of Mark has a great superiority (p. 116), but Mark has a motive for omitting the discourses; and he attaches a "puerile importance" to miracles (p. 117). The Gospel of Mark is less a legend than a biography written with credulity (p. 118). It would be rash to say that Mark has not been interpolated and retouched (p. 120).

If any one thinks that I have not been warranted in drawing a sharp distinction between "scientific theologians" and "counsel for creeds"; or that my warning against the too ready acceptance

* "Popular Science Monthly," May, 1889, p. 79.

of certain declarations as to the state of biblical criticism was needless; or that my anxiety as to the sense of the word "practical" was superfluous, let him compare the statement that M. Renan has made a "practical surrender of the adverse case" with the facts just set forth. For what is the adverse case? The question, as Dr. Wace puts it, is, "It may be asked how far can we rely on the accounts we possess of our Lord's teaching on these subjects." It will be obvious, that M. Renan's statements amount to an adverse answer—to a "practical" denial that any great reliance can be placed on these accounts. He does not believe that Matthew, the apostle, wrote the first Gospel; he does not profess to know who is responsible for the collection of "logia," or how many of them are authentic; though he calls the second Gospel the most historical, he points out that it is written with credulity, and may have been interpolated and retouched; and, as to the author "quel qu'il soit" of the third Gospel, who is to "rely on the accounts" of a writer who deserves the cavalier treatment which "Luke" meets with at M. Renan's hands?

I repeat what I have already more than once said, that the question of the age and the authorship of the Gospels has not, in my judgment, the importance which is so commonly assigned to it; for the simple reason that the reports, even of eye-witnesses, would not suffice to justify belief in a large and essential part of their contents; on the contrary, these reports would discredit the witnesses. The Gadarene miracle, for example, is so extremely improbable, that the fact of its being reported by three, even independent, authorities could not justify belief in it unless we had the clearest evidence as to their capacity as observers and as interpreters of their observations. But it is evident that the three authorities are not independent; that they have simply adopted a legend, of which there were two versions; and instead of their proving its truth, it suggests their superstitious credulity; so that, if "Matthew," "Mark," and "Luke" are really responsible for the Gospels, it is not the better for the Gadarene story, but the worse for them.

A wonderful amount of controversial capital has been made out of my assertion in the note to which I have referred, as an *obiter dictum* of no consequence to my argument, that, if Renan's work* were non-extant, the main results of biblical criticism as set forth in the works of Strauss, Baur, Reuss, and Volkmar, for example, would not be sensibly affected. I thought I had explained it satisfactorily already, but it seems that my explanation has only exhibited still more of my native perversity, so I ask for one more chance.

* I trust it may not be supposed that I undervalue M. Renan's labors or intended to speak slightingly of them.

In the course of the historical development of any branch of science, what is universally observed is this: that the men who make epochs and are the real architects of the fabric of exact knowledge are those who introduce fruitful ideas or methods. As a rule, the man who does this pushes his idea or his method too far; or, if he does not, his school is sure to do so, and those who follow have to reduce his work to its proper value, and assign it its place in the whole. Not unfrequently they, in their turn, overdo the critical process. and, in trying to eliminate errors, throw away truth.

Thus, as I said, Linnæus, Buffon, Cuvier, Lamarck, really "set forth the results" of a developing science, although they often heartily contradict one another. Notwithstanding this circumstance, modern classificatory method and nomenclature have largely grown out of the results of the work of Linnæus; the modern conception of biology, as a science, and of its relation to climatology, geography, and geology, are as largely rooted in the results of the labors of Buffon; comparative anatomy and paleontology owe a vast debt to Cuvier's results; while invertebrate zoölogy and the revival of the idea of evolution are intimately dependent on the results of the work of Lamarck. In other words, the main results of biology up to the early years of this century are to be found in, or spring out of, the works of these men.

So, if I mistake not, Strauss, if he did not originate the idea of taking the mythopœic faculty into account in the development of the Gospel narratives; and, though he may have exaggerated the influence of that faculty, obliged scientific theology hereafter to take that element into serious consideration; so Baur, in giving prominence to the cardinal fact of the divergence of the Nazarene and Pauline tendencies in the primitive Church; so Reuss, in setting a marvelous example of the cool and dispassionate application of the principles of scientific criticism over the whole field of Scripture; so Volkmar, in his clear and forcible statement of the Nazarene limitations of Jesus, contributed results of permanent value in scientific theology. I took these names as they occurred to me. Undoubtedly, I might have advantageously added to them; perhaps I might have made a better selection. But it really is absurd to try to make out that I did not know that these writers widely disagree; and I believe that no scientific theologian will deny that, in principle, what I have said is perfectly correct. Ecclesiastical advocates, of course, can not be expected to take this view of the matter. To them, these mere seekers after truth, in so far as their results are unfavorable to the creed the clerics have to support, are more or less "infidels," or favorers of "infidelity"; and the only thing they care to see, or probably can see, is the fact that, in a great many matters, the truth-seekers differ

from one another, and therefore can easily be exhibited to the public, as if they did nothing else; as if any one who referred to them, as having each and all contributed his share to the results of theological science, was merely showing his ignorance; and, as if a charge of inconsistency could be based on the fact that he himself often disagrees with what they say. I have never lent a shadow of foundation to the assumption that I am a follower of either Strauss, or Baur, or Reuss, or Volkmar, or Renan; my debt to these eminent men—so far my superiors in theological knowledge—is, indeed, great; yet it is not for their opinions, but for those I have been able to form for myself, by their help.

In "Agnosticism: a Rejoinder" (p. 484)* I have referred to the difficulties under which those professors of the science of theology, whose tenure of their posts depends on the results of their investigations, must labor; and, in a note, I add:

> Imagine that all our chairs of astronomy had been founded in the fourteenth century, and that their incumbents were bound to sign Ptolemaic articles. In that case, with every respect for the efforts of persons thus hampered to attain and expound the truth, I think men of common sense would go elsewhere to learn astronomy.

I did not write this paragraph without a knowledge that its sense would be open to the kind of perversion which it has suffered; but, if that was clear, the necessity for the statement was still clearer. It is my deliberate opinion: I reiterate it; and I say that, in my judgment, it is extremely inexpedient that any subject which calls itself a science should be intrusted to teachers who are debarred from freely following out scientific methods to their legitimate conclusions, whatever those conclusions may be. If I may borrow a phrase paraded at the Church Congress, I think it "ought to be unpleasant" for any man of science to find himself in the position of such a teacher.

Human nature is not altered by seating it in a professorial chair, even of theology. I have very little doubt that if, in the year 1859, the tenure of my office had depended upon my adherence to the doctrines of Cuvier, the objections to those set forth in the "Origin of Species" would have had a halo of gravity about them that, being free to teach what I pleased, I failed to discover. And, in making that statement, it does not appear to me that I am confessing that I should have been debarred by "selfish interests" from making candid inquiry, or that I should have been biased by "sordid motives." I hope that even such a fragment of moral sense as may remain in an ecclesiastical "infidel" might have got me through the difficulty; but it would be unworthy to

* "Popular Science Monthly" for June, 1889, p. 166.

deny or disguise the fact that a very serious difficulty must have been created for me by the nature of my tenure. And let it be observed that the temptation, in my case, would have been far slighter than in that of a professor of theology; whatever biological doctrine I had repudiated, nobody I cared for would have thought the worse of me for so doing. No scientific journals would have howled me down, as the religious newspapers howled down my too honest friend, the late Bishop of Natal; nor would my colleagues in the Royal Society have turned their backs upon me, as his episcopal colleagues boycotted him.

I say these facts are obvious, and that it is wholesome and needful that they should be stated. It is in the interests of theology, if it be a science, and it is in the interests of those teachers of theology who desire to be something better than counsel for creeds, that it should be taken to heart. The seeker after theological truth, and that only, will no more suppose that I have insulted him than the prisoner who works in fetters will try to pick a quarrel with me, if I suggest that he would get on better if the fetters were knocked off; unless, indeed, as it is said does happen in the course of long captivities, that the victim at length ceases to feel the weight of his chains or even takes to hugging them, as if they were honorable ornaments.*—*Nineteenth Century.*

LIFE IN THE SOLOMON ISLANDS.†

By C. M. WOODFORD.

IN October, 1885, I left England with the object of paying a visit to the group of islands known as the "Solomon Islands," for the purpose of making collections of the fauna, and, if possible, penetrating to the mountains of the interior of some of the larger islands, which had not yet been visited by white men. The Solomon Islands are a group lying about five hundred miles to the eastward of New Guinea. They extend for six hundred miles in a northwest and southeast direction, and are situated between the parallels of 5° and 11° south latitude, and the meridians of 154° and 163° east longitude. They were first discovered by Mendaña, the Spaniard, in 1567, who gave them the name of the Islands of Solomon, in order that his countrymen, supposing them to be the

* To-day's "Times" contains a report of a remarkable speech by Prince Bismarck, in which he tells the Reichstag that he has long given up investing in foreign stock, lest so doing should mislead his judgment in his transactions with foreign states. Does this declaration prove that the chancellor accuses himself of being "sordid" and "selfish," or does it not rather show that, even in dealing with himself, he remains the man of realities?

† From a paper read before the Royal Geographical Society, March 26, 1888.

islands whence King Solomon got his gold, might be induced to colonize them. There are seven principal islands and numerous smaller ones. The total land area of the group I estimate at fifteen thousand square miles, or considerably more than twice the area of Wales. They present evidences of recent volcanic activity. The island of Savo was an active volcano at the time the Spaniards discovered the group in 1567. There is an active volcano near the center of the island of Bougainville; hot springs and sulphur are found at Savo, Simbo, and Vella Lavella, while Kulambangara is an extinct volcano. During my residence of six weeks at Alu I experienced frequent shocks of earthquake, but of no great violence. The mountains of Bougainville rise to a height of 10,000 feet, and those of the other large islands to from 3,000 to 5,000 feet, except on Guadalcanar, where they reach an elevation of 8,000 feet. I made three attempts to reach the interior of this island, but was prevented by the hostility of the mountain tribes and the timidity of my guides. The highest point which I attained on Guadalcanar was 1,140 feet. Tin and copper have been found in small quantities on the island of San Cristoval, while I myself discovered copper on the island of Guadalcanar, and from the northwest end of the island of Malayta I obtained a mineral from the natives which proves to be iron pyrites. The people told me they used it for staining their teeth. The coast natives buy it from the bushmen in bamboos, at the fair that takes place on the coast every two or three days. The islands are for the most part clothed from the coast to the mountain-tops with the densest tropical forest, in which the immense ficus-trees, of several species, are often conspicuous objects, their trunks covered with creepers and ferns; the undergrowth consisting of small palms of many species, among which and over the trees the immensely long rattans or climbing canes twine in and out in inextricable confusion. In the neighborhood of native villages the beach will be found fringed with cocoanut palms, but my observation tends to prove that the cocoanut rarely grows unless planted. I know, however, that this is opposed to the opinions of some.

[Mr. Woodford made two or three visits to the Solomon Islands, by means of the schooners engaged in recruiting boys to work upon the plantations at Fiji, and returning them to their homes at the expiration of their terms of service; and by trading-vessels from Sydney. It is not necessary to follow the author in the details of his journeying from place to place, and of bargainings with the natives. We present the more striking incidents of life in this region.]

From the trading station at Rubiana, which is the center of the head-hunting district, our first visit was to a small island occupied by another trader. This island he is allowed to occupy on suffer-

ance only. It belongs to the natives of Sisieta; they will not sell it, as they use it for their cannibal feasts. I was told that six bodies were eaten here a fortnight before my visit. From here we went to a town called Oneavesi, and thence crossed to the small island of Rubiana proper, where we found nearly all the men away on a head-hunting expedition to the island of Isabel. I here photographed the interior of a tambu house, the post of which was carved to represent a crocodile. Along the rafters was a row of heads. I also took a photograph of a collection of sacred images, near to which was a heap of skulls, upon every one of which I

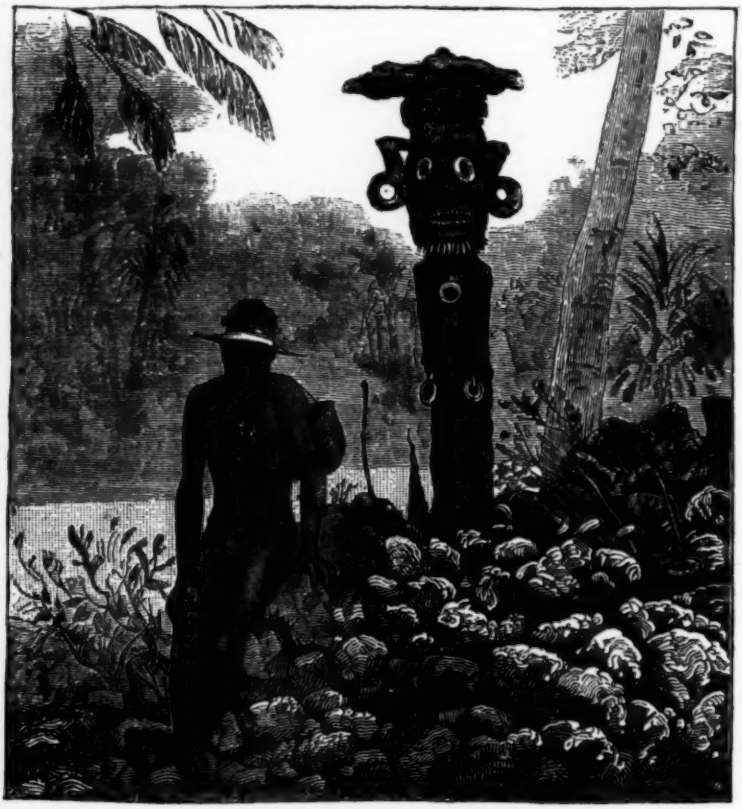

FIG. 1.—SACRED IMAGE AT RUBIANA.

noticed the mark of the tomahawk. These collections of images are to be found in nearly every town throughout the lagoon, and are strictly tambu (Fig. 1). I found out afterward that the natives strongly objected to my photographing them, or indeed approaching them at all. At another village close by on the same island we again found nearly all the male population absent on the same expedition. The women and those left at home were preparing a feast for them on their return. At the principal canoe-house

in another village we visited there were five large head-hunting canoes, profusely ornamented and inlaid with pearl-shell. The house was about eighty feet long, with a high-pitched roof, the end being closed in, but two narrow slits being left for the high prows of the canoes to pass through (Fig. 2). In this house there were eight heads; I recognized among them the straight hair of natives

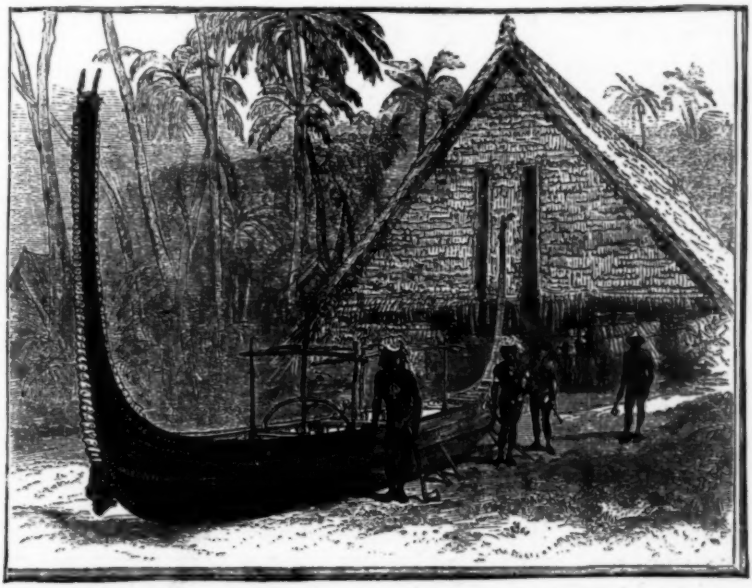

FIG. 2.—HEAD-HUNTING CANOE AND CANOE-HOUSE AT RUBIANA.

of the Lord Howe's group, and was told that a year or so previously a canoe containing sixteen of them had been driven from Lord Howe's group to Isabel, where they have been caught from time to time by the head-hunters. In another canoe-house in the same town I counted thirteen heads. After some persuasion they carried out the largest canoe for me to photograph. The Rubiana men returned next day from Isabel with five heads, from three men and two women; they also brought five prisoners alive. During the fortnight that I spent in the lagoon I heard of no less than thirty-one heads being brought home, as follows: Rubiana village, five; Sisieta, six; Kokorapa, three; Lokorokongo, seventeen.

I, for the second time, spent a fortnight at this place; and having on my previous visit gained the confidence of the two chiefs of Sisieta, named Wange and Ingova, I went frequently ashore at their town. On one occasion I saw the inauguration of a large trough for preparing and pounding food, the ceremony taking place in the chief canoe-house of the town. I was assigned a seat next to Ingova, while above my head were the eight heads pre-

viously mentioned. The trough was about thirty feet long, and carved to represent a crocodile. Twenty-two men were seated on each side of the trough, and an old man at either end. They had all their ornaments on, and wore their shields over their shoulders, while their spears and tomahawks were close behind them. The food, consisting of taro, yams, and nuts, was placed in the trough, and the men sat ready. An old man in full fighting rig was then seen advancing toward the house. Walking up to the entrance, he suddenly started back and raised his spear, exclaiming, "Basioto!" ("A crocodile!") and standing on the defensive. Ingova then advanced from the interior of the house, and, placing one hand on the crocodile's head, began a speech which lasted about ten minutes. At a given signal the men began pounding the food, all of them keeping excellent time. When they got tired or hot they were relieved by others, and the pounding was continued for over half an hour. I was then asked to go, and, not wishing to offend them, I did so.

[On another occasion the author had walked with some natives from Aola, on the coast of Guadalcanar, to a town called Kobua, situated on the river of that name, and about four miles inland.] While walking along the river-bank with my men we heard a number of natives approaching, shouting and making a great noise. I was told they were coast natives returning from a raid upon a mountain town. My men all stood on the defensive with their spears ready poised, and I got my revolver ready, but they proved to be friends. They were very proud of their victory, and told me that they had killed one man and got one alive. I saw the dead man's hand and a piece of flesh carried in triumph by one of them on his spear. I did not see the prisoner, and I was glad to hear afterward that he had escaped. It is these constant raids of the coast natives upon the bushmen, and retaliatory ones on the part of the bushmen upon the coast natives, that render it difficult and dangerous to penetrate any distance into the interior. I had been over three months at Aola before I could induce the natives to accompany me into the interior, during which time I had surveyed all the lower coast of the rivers in the neighborhood.

[A typical illustration of the vegetation of the islands is furnished in the picture of the sago palms (Fig. 3) on the Bokokimbo River, a stream which runs down from the mountains of the interior.] The vegetation [the author says] is here most luxuriant, and composed of large ficus and other large forest trees, with occasional clumps of sago and areca palms, but few cocoanuts. The river was ascended and surveyed for about ten miles, for the whole of which it runs through a rich alluvial flat, densely wooded.

[Valemanga, where the author stopped in an attempt to make

the ascent of Mount Vatupusau (4,360 feet high), was situated at the height of 800 feet on the top of a narrow ridge, sloping abruptly down on the eastern and western sides], and was surrounded with a stockade about seven feet high, with a narrow opening, closed at night, through which we squeezed one by one. In

FIG. 8.—SAGO PALMS AND NUTS—VIEW ON THE BOKORIMBO RIVER, GUADALCANAR.

weak places, sharpened bamboos were stuck in the ground on the inside of the fence to transfix any one breaking through. Walking into the center of the town, I inquired for the head man, and when he appeared I held out my hand to him, which he took, and then he put his arms round me and embraced me. The settlement consisted of ten or a dozen houses and thirty inhabitants. . . . At dusk we were conducted to a perfectly clean new house, with, as usual, the bare ground for floor, and were supplied with cooked yams. After we had finished our meal, the whole town crowded into the house, and my men sang a song, and when they had finished the women of the town sang one of their dismal chants. In the midst of the performance, Sosoni, one of my men, suddenly sprang to his feet, and, after a short speech, presented the chief

man of the town with three or four sticks of tobacco. I had not intended to make my present before morning; but, as I thought the opportunity a good one, I gave Beta an axe, a knife, and some pipes, matches, and a quantity of tobacco, and told him to present them with a suitable speech. Shortly afterward one of the men of the town stood up, and, leaning his two hands upon his tomahawk, returned thanks. Each man before commencing his speech gave a shrill scream, I suppose to attract attention, but the singing went on all the time. [A few days after this, eleven natives, consisting of six men, three women, two little girls, and a baby, arrived at Aola, being the sole survivors out of the thirty inhabitants. The town had been attacked at daylight two days after the author's visit, and the old chief, Tambougi, who had given the traveler the affectionate embrace, was among the killed.]

Natives of different parts of the group differ considerably from one another, but they belong to the Melanesian or Papuan type. The natives of Buka and Bougainville and of the islands of Bougainville Straits and of Choiseul are intensely black in color, but as one journeys eastward the color changes to a dark brown. They have woolly hair, but occasionally natives are met with wavy and in some cases straight hair. The men wear no clothes beyond the T-bandage usually met with among savage races, but frequently men are seen without even this. The natives of Alu, however, wear a small piece of calico round the waist. On San Cristoval and the more eastern islands the women wear a small plaited square of grass fiber, about six inches by four, which is suspended round the waist by a string and hangs down the front. Upon Malayta they wear the same, but one frequently sees women without even this. On Guadalcanar the women wear a series of fringes, one over the other, made out of some vegetable fiber resembling hemp. For working in they wear a similar fringe made out of a shredded banana-leaf. The dress of the women of Rubiana and the neighboring district was declared by Captain Cheyne, who visited the islands in 1846, to be indescribable. At Alu the women wore pieces of calico bought from the traders. These Solomon natives are not so addicted to the practice of tattooing as the lighter-colored Polynesians, probably because the pattern would not show so conspicuously upon their dusky skins. In San Cristoval, however, both men and women have frequently the face cut all over with a pattern of chevron-shaped cicatrices; and on Guadalcanar the same practice is in vogue, but the pattern takes the form of small circles, which are traced by a sharpened bone from the wing of the flying fox, and a small bamboo with the edge sharpened. The operation, which is completed at one sitting, is a particularly painful one, and the operator is highly paid for his trouble, tattooing being a profession.

Many of these natives pierce and gradually distend the lobe of the ear, and enlarge it by degrees until at length it attains an enormous size. On San Cristoval a circular disk of soft, white

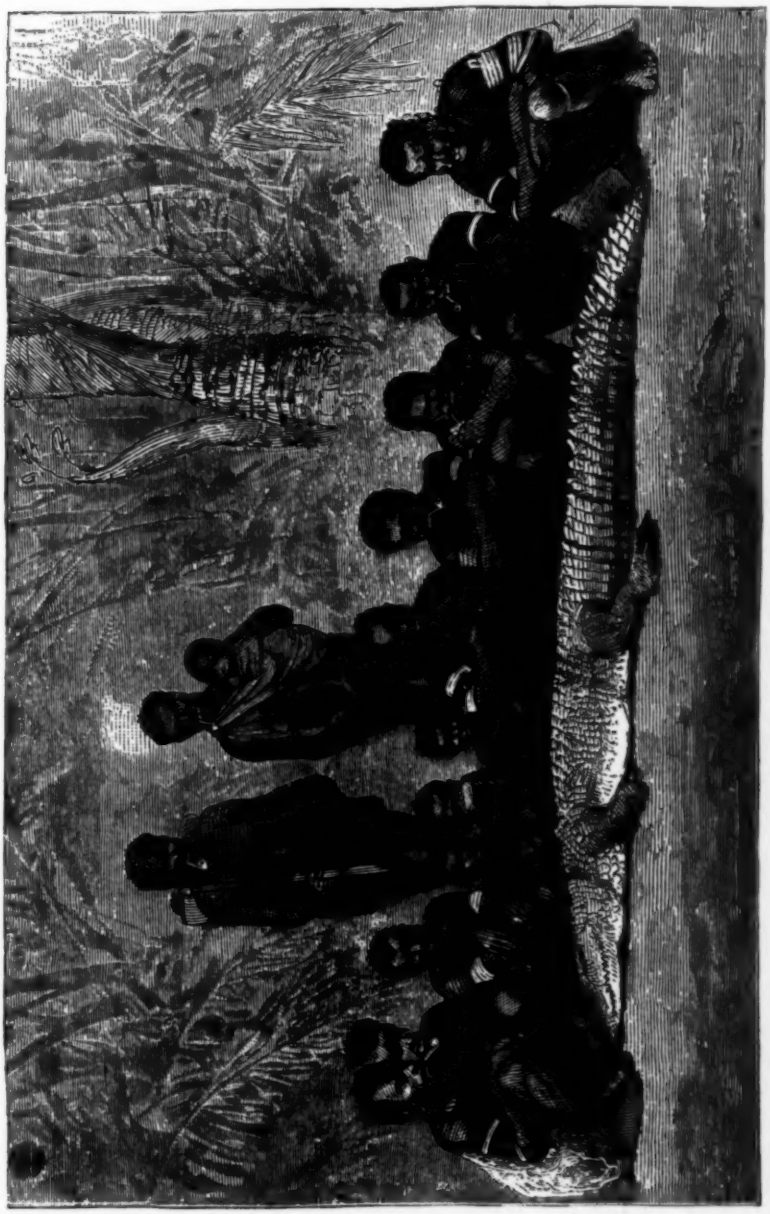

FIG. 4.—NATIVES OF AOLA, GUADALCANAR.

wood, from two inches to two inches and a half in diameter, is carried in the hole, but at Rubiana the hole was kept stretched by pieces of sago-palm leaf, or pandanus leaf, which were bent into

a hoop, and, by constantly exerting a pressure, tended to enlarge the hole. A boy, whose photograph I took at Rubiana, had the hole in his ears enlarged to a diameter of at least four inches. They are excessively fond of and prize highly armlets made from the shell of the giant clam (*Tridacna gigas*). A native chief, whom I saw at Santa Anna with a remarkably fine pair, told me he had given a boy for each. At Guadalcanar, Rubiana, and to the westward they take rather the form of bangles, and as many as eight or ten are frequently worn on each arm. Large crescents cut out of pearl-shell are frequently worn round the neck, and, especially on Malayta, frontlets of a white cowry. Perhaps, however, the ornament most highly prized is a necklace of dogs' teeth. A good necklace will consist of five hundred teeth, each one being carefully bored and mounted with great ingenuity. As only two teeth are available from each dog, it would require two hundred and fifty dogs to make a necklace such as I refer to. On San Cristoval, where most of the dogs' teeth come from, I am told that they extract the teeth from live dogs, burying them up to the neck in the ground for the purpose. Porpoise teeth, cuscus teeth, and the teeth of the flying fox are also used, but are not so highly valued as dogs' teeth.

The natives of Rubiana and New Georgia also wear a neck ornament known by them as a *buckea*. This is a ring cut from the solid shell of the *Tridacna gigas*, and suspended round the neck by a sort of plaited red straw. The buckea is more highly prized if it possesses a peculiar yellow stain, and I am told that the best are made from shells that are found as fossils in the bush in regions of coral upheaval.

I must not forget to mention the strings of bead-money, generally about a fathom in length, which are made from shells at the expense of great labor. It is of two kinds, red and white, the red being more highly prized by them.

Their weapons are bows and arrows, spears, clubs, tomahawks, and defensive shields. But, while the natives of San Cristoval and Malayta use the arrow, spear, and tomahawk, I never saw on Guadalcanar any arrows or bows except those used for bird-shooting. At Rubiana and New Georgia also arrows are not used, the tomahawk and spear being preferred. But it is on Bougainville that the finest specimens of arrows and spears are found. In fact, the latter, barbed with the wing-bones of the flying fox, are eagerly sought after and bought by the natives of the more eastern islands, the Alu natives paying two or three visits a year to Bougainville for the purpose of buying spears, arrows, baskets, and other things in the manufacture of which the Bougainville natives excel.

Perhaps the thing that most strikes a stranger visiting the

group is the beauty of shape and decoration of the canoes. These vary in size from the tiny thing just able to support a boy of twelve, to the great head-hunting canoes, capable of carrying fifty or sixty men. They are built of planks laboriously adzed down from the solid tree, and are sewn together with a tough vegetable fiber, the seams being calked with a sort of putty scraped from the kernel of a nut (*Parinarium laurinum*) that grows plentifully in the bush. This vegetable putty sets perfectly hard in a few hours and is quite water-tight. The canoes are ornamented exteriorly at bow and stern with white cowry shells and inlaid with pieces of pearl-shell cut into patterns, and at the bow end, just above the water-line, is often a small human-shaped figure-head. These canoes are propelled solely by paddles, being unadapted to sailing, and, being long, narrow, and light for their size, they travel at a great rate.

Except perhaps on Bougainville, the use of stone implements has gone out among these natives, but while at Guadalcanar I obtained more than two hundred stone adzes. These were brought me by the natives, and were for the most part dug up by boys upon the sites of old houses. I asked an old man to mount me one upon a wooden handle in the correct way. The same form of handle is still used, but a plane-iron is now employed instead of the stone axe. With these they cut out their canoe-planks and fashion the wooden bowls in which they serve their food.

The houses vary in shape somewhat in different parts of the group, and in Florida and Fauro houses built on posts may be seen. On Guadalcanar the eaves of the roof come right down to the ground. The material is always the same, the leaf of the sago palm, which makes a durable and dry roof. There is no floor but the bare ground, but rough couches are made of palm-stems laid side by side, and raised from a few inches to a couple of feet from the ground. They are most uncomfortable to sleep upon, being very hard and rough and invariably too short. A fireplace is made in the center of the house, and the smoke finds its way out through the door, or through the roof or sides of the house. Strings of pigs' jaw-bones, cuscus and flying-fox skulls, fishes' bones, turtles' heads, and sometimes human jaw-bones may be seen strung on strings along the rafters as mementoes of former feasts; but the human heads, at least in the head-hunting districts, are reserved for the canoe-houses. These are larger and better built than the ordinary dwelling-houses, and are *tambu* (tabooed) for women—i. e., a woman is not allowed to enter them, or indeed to pass in front of them.

Both men and women take their parts in the gardens; felling the trees and fencing against wild pigs being men's work, while the actual gardening—planting, weeding, and digging—is done by

the women. Having few wants, blest with a climate in which the rudest methods of cultivation produce abundance of food for their use, they ought to be a happy and contented race, and no doubt, were security to life more assured, they would be. But a man would as soon think of going to his garden of a morning without his spear and tomahawk as an Englishman would of wearing his hat in church. The greatest distinction a native can earn is to have taken a life, and it matters not whether it is an old woman surprised working in her yam-patch, or a man surprised and killed in the bush, the glory is just as great. Such a thing as a square, stand-up fight between equal numbers I never heard of. This renders them suspicious in the presence of strangers; always ready for treachery themselves, they are constantly suspecting it in others. Having given them a bad character in their dealings with one another, I must in justice say that my own relations with them were throughout of the most friendly character.

The shark is held in high veneration among certain of these natives, and notably upon the island of Savo. The Savo natives say that their island was made by the shark, who carried the stones there and planted yams and cocoanuts, and put upon it men and women, and the bird known as the *megapode*. The megapodes increased so rapidly that they began to make havoc by digging in the yam-patches. The men went to the shark and asked him to take the megapodes away. This was done, but now the men missed the megapode's eggs, which are a favorite article of food with them. They accordingly went again to the shark and asked him to bring the birds back, but to confine them to one place. This request was also complied with. The result may be now seen: the megapodes lay their eggs on two large open patches of sandy ground, which are several acres in extent, and nowhere else on the island. These laying-grounds are fenced off into small divisions for different owners, and I am told that several thousands a day are taken out of them. I myself bought eighteen eggs for the value of three-halfpence when calling there.

The sharks at Savo grow to a great size and are extremely bold. At the time of a child's birth the mother decides whether it belongs to the land or the water. If to the latter, it is thrown into the sea at death, with all the property it may have accumulated during life. If the mother declares it belongs to the land, it is buried ashore, the property also being buried with it, which, strange to say, is always found to have been stolen a few days afterward by the *devil*.

These natives believe in the power of some of their number to produce rain, while I met with a belief in the existence of a man in the moon, which was related to me by a native of Aola, named Muri Lau.

I can not conclude my description of the natives and their customs without some reference to cannibalism and head-hunting. I may state that very few white men have ever had the good fortune to see a cannibal feast, as the natives, knowing the detestation in which the practice is held by white men, always keep the occurrence as quiet as possible. On one occasion only did I ever see human flesh, and the owner assured me he was not going to eat it. I never heard of cannibalism the whole (six months) time I was living at Aola on Guadalcanar, and the natives, in answer to my inquiries, most strenuously denied the practice, but this, of course, they would do. On San Cristoval it is said to be common, and bodies are hawked about for sale from town to town, and the same is the case on Malayta. The head-hunters of New Georgia and the neighboring islands are also notorious cannibals, while my own boy, Hogare, who was a native of the island of Buka, confessed to me that the practice was common there. Not only will the New Georgian natives eat the bodies of those killed in battle, or prisoners, but they will exhume the bodies of people recently buried for their disgusting purpose.

Throughout the group one constantly sees human skulls hung up either in or outside the houses, but it is from New Georgia and the adjacent islands that head-hunting is carried on to its fullest extent. Among these natives it appears to be a perfect passion. No canoe-house can be completed and no canoe launched without a head being obtained. They make long voyages in their large *tomakos*, or head-hunting canoes, for the purpose of securing heads, the chief hunting-ground at the present time being the two islands of Choiseul and Isabel, ninety to one hundred miles away, which, however, are becoming somewhat "worked out." The basest treachery is often employed. They will at times visit a village as friends, and, after staying for a day or two, at a given signal turn upon their hosts, and either kill them or take them alive. Such a case occurred while I was at Rubiana. At other times they will surprise or cut off a party fishing on the reef, and no matter whether they are men, women, or children, the heads count. The heads, after being slightly smoked, are stuck up along the rafters of the roof in the canoe-houses, and I have myself counted thirteen recent heads in a house at Sisieta. Occasionally the head-hunters themselves meet with reverses; and while at Rubiana I inquired the reason of some particularly fine cocoanut-trees having been cut down; I was told that it was in consequence of the death of a chief who was killed on a head-hunting expedition to Isabel.

"SCIENTIFIC CHARITY."

By A. G. WARNER, Ph. D.

IN 1844 C. C. Greville made this entry in his journal: "We are now overrun with philanthropy, and God only knows where it will stop, or whither it will lead us!" When he wrote these words he was appalled lest the malign influence of philanthropy should avail to secure additional legislation for the protection of women and children in the mines and factories of England.

During the first half of the present century the English philanthropists and the English economists joined issue squarely upon two great questions, and the victor in one case was vanquished in the other: the economists won in the fight for the reform of the poor-laws, the philanthropists in the fight for factory legislation. Of course, no sharp line of distinction can be drawn between the two classes thus labeled, but in the main it is true that the apostles of self-sacrifice were on one side and the apostles of self-interest on the other. Especially in the struggle for factory legislation were the two classes distinct, and distinctly antagonistic. Cobden doubted the sincerity of Shaftesbury, and Shaftesbury rejected the reasoning of Cobden. Results have indicated that

> "Each was partly in the right,
> And both were in the wrong."

While political economy was getting itself called the "dismal science," it was actually fighting the battles of the poor as well as the rich; and while philanthropy was being charged with a mischievous meddlesomeness, hurtful to the poor and fatal to the industrial supremacy of England, it was, in truth, cutting the tap-root of the Chartist agitation and re-establishing the foundations of British industry. From these dual experiences of success and failure in the attempted solution of social problems the obvious conclusion has been that neither class of thinkers can be regarded as infallible, while at the same time the conclusions of neither can be considered valueless.

The conclusion is commonplace enough, but the unusual feature of the case is that both parties seem to have accepted it entire. All are pretty well agreed that both sense and sentiment are necessary to guide us properly along the devious paths of politico-economic investigation. He who approaches a social question from the side exclusively of the reason, or exclusively of the emotions, is apt, like the blind man feeling of an elephant, to mistake a part for the whole, and to err accordingly. In consequence of a fuller appreciation of the necessity for the many-sided

investigation of social questions, we have lately come to hear of a "new political economy," and very lately of a "new charity." The former is said to be less "dismal" and the latter more "scientific" than their respective progenitors, and it is hoped that a mutual exchange of the surest conclusions and the best methods in each will result in the improvement of both.

The title of this paper has been put in quotation-marks because it is believed by some that no such thing as "scientific charity" exists, and, when these two words are joined, that either the adjective or the substantive or both must lose all natural significance. They say that those interested in science and those interested in charity have an equal right to complain of the phrase, and that its use is only another instance of the confused thinking that results from a tendency to count our sciences before they are hatched. But right or wrong the term exists, and will serve as well as another to stand for a certain phase of recent charitable work. It has come to be much used by the members of the National Conference of Charities and Correction; and it seems unlikely that one more profanation of the word "science" can add much to the exasperation of those who contend for its more restricted application.

Social pathology is not an attractive study. The failure of the unfit to survive forms the subject of the dreariest chapter in social science. Indeed, it is so entirely dreary that it is seldom written. Those calling themselves scientists have been very willing to leave the care of defectives and incapables to the philanthropists, and equally willing to complain of the latter for alleged bad management. Those interested in the new charity are endeavoring to devise such methods of work as will make benevolence more certainly beneficent, and such methods of investigation as will enable them to give at least an approximate answer to Greville's question, "Whither will philanthropy lead us?" Certainly in the past it has led to many quagmires, and much has been and still more could be written on the subject of philanthropy as a failure.

"We can have as many paupers as we will pay for." The truth of this somewhat frequently quoted statement one might possibly reach by a study of his own inner consciousness. Such a study would show, probably, the truth of Emerson's assertion that "men are as lazy as they dare to be," and thence, by deductive reasoning, we might prove the correctness of the conclusion indicated. But the new political economy is inclined to ask that *a priori* reasoning should be re-enforced by reasoning from observed facts. Now, fortunately, the truth we are trying to establish is capable of demonstration by experiment. The apparatus needed is very simple, and consists merely of a pocketful of five-

cent pieces. Provided with these, go to any crowded thoroughfare, and give them out to the children or others that ask for help —perhaps under pretense of peddling. Notice how the number of askers multiplies—how older children and better-dressed children take part in the asking—and you will realize that, if your pocket were big enough, you could pauperize half the city. The same experiment may be tried by simply giving a little money to each one that chooses to ring your door-bell and ask for it. It may almost be considered fortunate that a great nation was so unfortunate as to try just such experiments on a gigantic scale. Walker thus summarizes the influence of English outdoor poor relief while the Gilbert Act was in force: "The disposition to labor was cut up by the roots; all restraints upon an increase of population disappeared under a premium upon births; self-respect and social decency vanished before a money-premium on bastardy." Cities in our own country—notably Brooklyn and Philadelphia—have found that, when public outdoor relief, given prodigally for a long series of years, was cut short off, the number of indoor poor actually decreased, as also the demands upon the private charities of the cities, and this in the face of an increasing population.

It is characteristic of the new or scientific charity as opposed to purely emotional philanthropy that it regards poverty as an evil to be assailed in its causes. It does not merely pity poverty, but studies it. It believes that a doctor might as well give pills without a diagnosis, as a benevolent man give alms without an investigation. It insists that "hell is paved with good intentions," and that the philanthropist must be careful as well as kindly.

Mr. Smiley, in his recent article in "The Popular Science Monthly" on "Altruism economically considered," says but little of this more rational phase of charitable work. The evils he condemns are very evil, but others are attacking them as vigorously as himself, and possibly along lines of greater strategic advantage. To prosecute existing charitable methods at the bar of true charity is apt to have more practical results than to arraign the same culprits at the bar of political economy.

Most of the workers in the new charity in this country have entered more or less fully into the movement for what is known as "charity organization." Speaking broadly, the purpose of this movement is to make the benevolent work of our large cities more systematic and more intelligent. The plans of those interested in the movement are already sufficiently well realized, so that each year they seek out, analyze, classify, and record a vast number of facts regarding the poor and poor-relief in the principal cities of the country. An examination of some of the statis-

tics already collated by them will best serve to indicate their methods and the value of their work.

Charity organization societies have been formed in cities embracing about one seventh of the entire population of the United States. Thirty-four of them, representing cities containing one eighth of the population of the country and probably one sixth of its pauperism, reported to the fourteenth National Conference of Charities and Correction, which met at Omaha in September, 1887. From careful estimates it is supposed that these cities contained about 456,000 paupers. Over 62 per cent of this number actually came under the cognizance of the charity organization societies of the cities indicated—that is, they dealt with 57,000 families, containing about 285,000 persons. Not all of the societies made full reports, or they made them in such a form that the facts contained were not easily comparable with those reported by the others. Twenty-five societies, however, agreed in classifying under four heads the cases that came before each. These societies made a careful analysis of nearly 28,000 cases, including something over 100,000 persons. The result by percentages of the classification above referred to was as follows:

Should have continuous relief	10·3 per cent.
" temporary "	26·6 "
Needing work rather than relief	40·4 "
Unworthy of relief	22·7 "

Charles D. Kellogg, who made the report to the National Conference, goes on to say: "For several years there has been a very close correspondence of published experience between Boston and New York, and in these cities the percentage of those needing work rather than relief has been 53·4, and of the unworthy, 15·8. . . . On the other hand, there is a notable unity of opinion that only from 31 to 37 per cent, or, say, one third of the cases actually treated, were in need of that material assistance for which no offices of friendly counsel or restraint could compensate. The logical application of this generalization to the whole country is that two thirds of its real or simulated destitution could be wiped out by a more perfect adjustment of the supply and demand for labor and a more vigorous and enlightened police administration. Subsequent and wider experience may modify this conclusion, but hardly can wholly overturn it; and, while it stands, it is of the highest significance in the solution of the poor problem." Not only are these deductions of "the highest significance in the solution of the poor problem," but they contain important suggestions for the philanthropist's should-be friend, the student of political economy.

But it was felt by the charity organizationists that a still more

penetrating analysis was needed, and at the meeting of the sixteenth National Conference, where about forty representatives of this branch of philanthropic work were present, a schedule was adopted for the collation of more elaborate and, it is hoped, more useful statistics. This schedule, except for a few minor alterations and additions, is the same as the one elaborated and used by the Buffalo society. As an example of the manner in which the figures will tell their story when collated, we may glance at some of the results reached by the Buffalo society through a very careful study of 1,407 families, including 5,388 persons. The chief cause of destitution was adjudged to be lack of employment in 263 cases, sickness in 326, no male support in 373, intemperance in 124, physical defects in 113, insufficient earnings in 87, accidents in 45, imprisonment of bread-winner in 35, shiftlessness in 26, and insanity in 15.

The personal equation must enter very largely into the collection of such statistics. For instance, it might be inferred *a priori*, from the foregoing figures, that those who were responsible for the decisions are not rabid "temperance people" nor prohibitionists. Such is, indeed, the fact; but, at the same time, it must be said that in Boston, and among workers inclined to give intemperance its full meed of discredit as a cause of poverty, a careful statistical analysis of this character convinced them that it was the chief cause in only about half the cases. Though statistics of this nature may not be the firmest ground to tread upon, they yet afford better footing than the quicksands of hap-hazard opinion.*

In some matters, also, the facts are more tangible, and the results, therefore, more reliable. For instance, it has for some time been the opinion of practical workers that a considerable portion of the most hopeless poverty is caused by the decay of the ties of the family. It is found that, in the 1,407 families reported on in Buffalo, there were, in fact, 183 deserted wives. Where, as in this case, investigation merely confirms a previous opinion, it is still of the greatest use, because it enables the workers to make a more cogent appeal for remedial legislation.

Recently, more than in the immediate present, it was the fashion to talk as though a common-school education was the one thing needful to cure all social ills, and to bring down upon us an imminent millennium. The reformers of that time went to battle with a spelling-book shield that might have borne the device of a schoolmaster rampant. In such a connection it is interesting to notice that in the 1,407 destitute families investigated in Buffalo it was found that the respective heads of 1,019 of them could both

* See an article by the present writer, "Notes on the Statistical Determination of the Causes of Poverty," in the "Publications of the American Statistical Association," March, 1889.

read and write, that 49 others could read but not write, and that only 339, or twenty-four per cent, were wholly illiterate.

It will be seen from the foregoing examples that the field of investigation upon which the charity organizationists have entered is a large and important one. A good deal might be said in the way of criticism, especially of the analysis of the causes of poverty, but it is rather the purpose of this paper to describe than to criticise. The facts it is aimed to accumulate are of a character that could not be got by public officials without very great expense, since they take account of the cases of many dependants whose names never appear on the records of public poor-relief.

Besides the statistics, which all the societies will work together to accumulate, different societies have undertaken elaborate special investigations into the heredity of pauperism and similar topics. Oscar C. McCulloch, at the last National Conference, read a paper entitled "The Children of Ishmael: a Study in Social Degradation," which was based upon such an investigation made by the society in Indianapolis. It gave the hideous story of thirty interrelated families, embracing two hundred and seventy persons, nearly all of whom belong to the pauper and criminal classes, as did their ancestors before them. The study resembles that which Dugdale made of the Juke family, by which it was suggested; but it embraces a larger number of families formerly distinct.

The workers in the new charity are active propagandists. They insist continually upon the evils of indiscriminate giving. They assail the public authorities with facts and figures, and the churches with biblical quotations. They assure the latter that bread indiscriminately given is cast not "upon the waters," but into the bottomless pit—that it is "the bread by which men die." They establish in each city an office to serve as a clearing-house of charities, and so endeavor to prevent the overlapping of the relief given by different agencies. Their general view of the situation enables them to devise new and needed forms of benevolence, and to ascertain what additional legislation can be really helpful.

It is very satisfactory when the conclusions of one set of thinkers coincide with the conclusions of others who have approached the same subject from a different standpoint. When, therefore, the philanthropist, trying to think and work in accordance with the principles of enlightened self-sacrifice, finds himself agreeing in theory and practice with the economist whose guiding star has been "enlightened self-interest," there is reason to congratulate them both. In speaking in this manner, we of course ignore the philosophical subtlety by which it is said to be proved that all our actions must necessarily have their origin in motives of self-interest. Assuming the proof of this to be perfect, it is yet to be said that the different forms in which self-interest manifests itself

have been so differentiated that we may rightly separate and classify them. The man who is convinced that all organic life came from a single form is yet justified in practical—e. g., gastronomical—affairs in making a distinction between meats and vegetables, or even between beefsteak and mutton. So, there is a practical if not a philosophical difference between the motives that guide men in stock speculations and those that guide them in the founding of hospitals. To reach charity by the way of self-interest is following too roundabout a road for the average man or the average thinker, and many there be that have failed most sadly in the attempt.

It is therefore exceedingly fortunate that the philanthropists seem likely to work out their own salvation from mischief-making by studying with scientific care the lessons that their own experience teaches. Such a course not only gives valuable facilities for checking the conclusions of those who have thought and worked along other lines, but it secures the acceptance by those charitably inclined of correct ideas much more readily than could any amount of outside pressure. The dictates of wisdom are formulated in language to which they are accustomed, and the motives to which appeal is made are those to which they have taught themselves obedience. Not that acceptance of the new ideas is easy under any circumstances for those trained in the older methods. It can only be said that it is a trifle less difficult to rout this variety of old fogyism by attacking from within rather than from without.

But there is, happily, an increasing number of those who appreciate the fact that the introduction of scientific methods into charitable work will not hamper charity but aid it; that the resulting restrictions that may be placed upon us will merely guide our sympathies, and not thwart them. The restraints that will be put upon benevolence will be merely to prevent its waste and insure its usefulness—"restriction for the purpose of expansion." Scientific methods carefully used for such purposes will not make the charity of the future cold-blooded and calculating, but will prevent it from being foiled, defeated, and turned back from its high purposes by its own gratuitous blunders; they will render that charity helpful, constructive, progressive, and make it possible that love of neighbor may "shape with growing sway the growing life of man."

THE Rev. Dr. Dallinger, who is also an eminent student of microscopic life, remarked in a recent lecture at Birmingham, England, that since the human mind had given itself fearlessly and without bias to the study of the phenomena, evolution had become no longer a bugbear, and might be looked upon, even by the most timid theologian, as the actual method of creation.

THE INFLUENCE OF RACE IN HISTORY.*

By M. GUSTAVE LE BON.

HISTORICAL studies have undergone a great transformation in our days. Almost exclusively literary a few years ago, they are tending at this time to become almost as exclusively scientific. It is not the recent progress of archæology alone that has caused a remodeling of our knowledge and our ideas in history. The discoveries in the physical and natural sciences have had a still greater effect upon them; and it is by means of these discoveries that the notion of natural causes is entering into history more and more, and that we are habituating ourselves to consider historical phenomena as subject to laws as invariable as those that control the course of the stars and the transformations of bodies. The part which all the ancient historians attributed to Providence or to chance, is now no longer attributed to anything but natural laws, as entirely removed from chance as from the will of the gods.

The new ideas which are entering into history are due chiefly to the progress of natural science. Making more and more evident the preponderant influence of the past on the evolution of beings, it teaches us that we must first study the past in societies to comprehend their present condition and foresee their future. In the same way that the naturalist now finds the explanation of beings in the study of their ancestral forms, the philosopher who wishes to comprehend the genesis of our ideas and institutions should examine primitive usages. Thus regarded, history, the interest of which might seem but slight so long as it is limited to the enumeration of dynasties and battles, is acquiring an immense significance.

The method which the modern man of science applies to history to-day is identical with that which the naturalist applies in his laboratory. A society can be regarded as an organism in process of development. There is a social embryology as there are an animal and a vegetable embryology, and the laws of evolution that govern them all are of the same order. Social embryology, or the study of civilizations, shows us the series of advances by which the marvelous and complicated mechanism of refined societies has issued from the savage condition in which the first men long lived; how our thoughts, feelings, institutions, and creeds had their roots in the primal ages of mankind. Instead of, as formerly, seeing a gulf between the peoples who ate their aged parents and those who lavish cares upon them in their old age and weep at their tombs; between those who look upon their

* From the author's work, "Les Premières Civilisations," now appearing in parts.

women as lower animals belonging to all the members of the tribe, and those who have made them the object of a chivalrous cult; between those who expose their malformed children to perish, and those who lodge their idiots and incurables in magnificent hospitals—we trace out the close bonds which connect, through the ages, the most different thoughts, institutions, and creeds. We realize that present civilizations have been derived from past civilizations, and contain in the germ all the civilizations to come. The evolution of thoughts, religions, industries, and art—in short, of all the elements that enter into the constitution of a civilization—is as regular and inevitable as that of the different forms of an animal series.

The factors that determine the birth and development of the constituent elements of a civilization are as numerous as those which control the development of a living being. The study of them has as yet hardly begun; but the influence of some of them can be brought into evidence. One of the most important among these factors is race—that is, the aggregation of the physical, moral, and mental traits that characterize a people.

When human races appear in history they have generally already acquired marked characteristics, which afterward undergo only very slow transformations. The oldest Egyptian basreliefs, on which are depicted the various types of the peoples with whom the Pharaohs had to do, are proof that our present grand characterizations of races could have been applied even then, in the dawn of history.

The various human races had formed themselves during the hundreds of thousands of years that preceded historical times. They were so formed, no doubt, like all the animal species, by means of slow changes produced by variability of the environment, limited by selection and enforced by heredity. The first step toward understanding the history of a people and the origin of their institutions, moral ideas, and creeds, is to study their mental constitution. It is vain to ask from anatomical characteristics, as has been done for a long time, for the means of differentiating races. Psychology alone permits a precise definition of racial distinctions. It shows us that peoples of similar mental constitution will have similar fates when placed in like circumstances, however they may differ in external aspect. In this way we have been able to make a rational comparison between the modern English and the ancient Romans. There exists, in fact, an evident mental relationship between these two peoples; the same indomitable energy of character, the same respect for their institutions, the same capacity for conquering people and for holding colonies. But, regarding the external type, there is a complete want of resemblance between the two peoples.

Two fundamental psychological elements to be always studied among any people are character and intelligence. Character is infinitely more important to the success of an individual or a race than intelligence. Rome, in her decline, certainly possessed more superior minds than the Rome of the earlier ages of the republic. Brilliant artists, eloquent rhetoricians, and graceful writers appeared then by the hundred. But she was lacking in men of manly and energetic character, who may perhaps have been careless of the refinements of art, but were very careful of the power of the city whose grandeur they had founded. When it had lost all of these, Rome had to give way to peoples much less intelligent but more energetic. The conquest of the ancient, refined, and lettered Græco-Latin world by tribes of semi-barbarous Arabs constitutes another example of the same kind. History is full of such.

While character thus plays the chief part in the historical development of a people, it is intelligence that prevails in determining their civilization; but it must be creative, and not assimilative only. Peoples having only an assimilative intelligence, like the Phœnicians of old and the Mongolians and the Russians of the present time, are capable of appropriating more or less of foreign civilization, but can not make civilization advance. Peoples endowed with a certain intelligence, like the Greeks in antiquity and the Arabs in the middle ages, have been the factors of all the general progress by which mankind has profited.

The most superficial observation soon demonstrates that the several individuals composing a race differ from one another in physical aspect as well as in moral and mental constitution; but a little more attentive observation will show that under these apparent diversities is hidden a mass of characteristics common to all the individuals of the race, the aggregation of which constitutes what has justly been named the national character of a people. When we speak of an Englishman, a Japanese, or a negro, we at once attribute to him—and without hardly ever being much mistaken—a collection of general traits which are a kind of precise condensation of the characteristics of his race. These national characteristics, created among homogeneous peoples by the long-continued influences of the same mediums, the same institutions, and the same creeds, play a fundamental, though invisible, part in the life of peoples.

In human races, as in animal species, some offer many varieties, others but few. The fewer varieties a race presents—or the less they diverge from a mean type—the more homogeneous it is. Such, for example, is the modern English race, in which the ancient Briton, the Saxon, and the Norman have been effaced to form a wholly new and quite distinct type. If, on the contrary, the groups have been juxtaposed without having been sufficiently

mixed, the race continues heterogeneous, and the mean type becomes more difficult to establish, because the common traits that compose it are less numerous. It is easy to comprehend that the more homogeneous a race is, the stronger it will be, and the more called upon to march rapidly in the way of progress. When, on the contrary, thoughts, traditions, creeds, and interests remain separated, dissensions will be frequent, and progress always slow and often completely hindered.

We see by this how important to the explanation of the history of a people is the study of its composition. We see also that the word "people" can not be in any case considered synonymous with "race." An empire, a people, or a state is a more or less considerable number of men united by the same political or geographical necessities, and subjected to the same institutions and laws. These men may belong to the same race, but they may equally belong to different races. If the races are too dissimilar, no fusion is possible. They may, under necessity, live side by side, like Hindus subject to Europeans, but we must not think of giving them common institutions. All great empires uniting dissimilar peoples are created only by force, and are condemned to perish by violence. Those only can endure which are formed slowly by the gradual mixture of races differing but little, continually crossing with one another, living on the same soil, subject to the action of the same climate, and having the same institutions and creeds. These different races may thus, after a few centuries, form a new homogeneous race.*

As the world grew old, the races gradually became more stable, and their transformations by mixture rarer. In prehistorical times, when man's hereditary past was not so long, when he had neither well-fixed institutions nor well-assured conditions of existence, mediums had a more profound action upon him than now. Civilization has permitted man to subtract himself, to a large extent, from the influence of the medium, but not from that of his past. As mankind grows older, the weight of heredity grows heavier. For heredity to act in the mixture of races, it is necessary that one of the races shall not be too inferior to the other in numbers, and that their physical and mental constitutions shall not be too different.

The first of these conditions is fundamental. When two different races are brought together, the more numerous one absorbs the other. In a black population, a few families of whites will

* The mechanism of this fusion of the different elements of a race is rarely observed. I, however, witnessed it once, during my travels, among a mountaineer population isolated in the interior of Galicia, at the foot of the Tatras Mountains. The memoir in which I recorded my observations appeared in the "Bulletin de la Société de Géographie de Paris" (1888).

disappear without leaving any traces. Such has been the lot of all conquering peoples which, though strong in arms, have been weak in numbers. Those only have escaped obliteration which, like the Aryans in India, formerly, and the English, also in India, to-day, have observed a rigid system of castes, preventing the mixture of conquerors and conquered. Except where the rule of caste has operated, the general result has been to see the conquering people absorbed, after a few generations, by the conquered. It has not disappeared, however, without having left traces of its work in civilization behind it. Egypt, conquered by the Arabs, quickly absorbed its conquerors; but they left the most important elements of civilization—religion, language, and arts—there. A like phenomenon took place in Europe among the peoples called Latin. The French, Italians, and Spaniards have, in reality, no traces of Latin blood in their veins; but the institutions of the Romans were so strong, their organization was so perfect, their influence in civilization so great, that the countries occupied by them for centuries have remained Latin in language, institutions, and peculiar genius.

It is not, however, by reason of its strength that one people imposes its civilization upon another; very often the conquered people leads the conquerors in this line. The Franks finally triumphed over the Gallo-Roman society, but they were in a short time morally conquered by it. They were also physically overcome, for they had plunged into a population more numerous than themselves. This conquest of the conquerors by the conquered is to be seen in a still higher degree among the Mussulman peoples. It was precisely when the political power of the Arabs had wholly disappeared, that their religion, language, and arts were spread most extensively.

But when races too dissimilar are brought in contact by the chance of invasions and conquest, fusion is impossible by any force, and the only result that can be produced is the extermination of the weaker race. This disappearance of the inferior people in the face of a superior race does not always take place by means of a systematic and sanguinary extermination; the simple action of presence, to use a chemical term, is sufficient to bring on destruction. When the superior people has established itself in a barbarous country, with its complicated mode of life and its numerous means of subsistence, it monopolizes and masters the living forces of the country much more easily and speedily than the former occupants. The latter, formerly masters of all the resources of the land, come at last to only toilsomely gleaning what their conquerors have left.

When two different races become mingled, notwithstanding a great inequality of civilization, the result is disastrous rather to

the inferior than to the superior race. It soon disappears, and gives place to a race which may represent, in a mental respect, a kind of mean between the two races, but morally is inferior to either of them. Half-breeds have never made a society advance; the part they have played has been to degrade the civilizations of which they have by chance been the heirs. The disastrous results of such mixtures of superior races with inferior were clearly perceived by the most ancient civilized peoples. This was doubtless the origin of that rule of castes, preventing unions between persons of different races, which we find in many ancient societies. Without it, man would never have risen above the dawn of civilization.

But, while the mixture of races which have reached very unequal stages of evolution is always disastrous, the result is otherwise when these races, although still possessing different qualities, have arrived at nearly the same period of development. Their qualities can then very usefully complement one another. The republic of the United States has been formed by precisely such a mixture of races, already elevated in civilization and having qualities complementary to one another. The people owes its astonishing vigor to the fact not only that it is constituted of a mixture of elements—English, Irish, French, German, etc.—already highly developed, but also that the individuals through whom the crossing was effected were themselves the results of a selection from among the most active and vigorous members of those nations.

The general laws which we have just summarized can of themselves furnish the explanation of a large number of historical events. They show, for example, why one conquest was the origin of a brilliant civilization, and why another introduced an era of disorder and anarchy; why the Oriental has always easily imposed his yoke and his customs upon Orientals whose mental constitution was like his own; and why struggles between Orientals and Westerners have been so ferocious, and usually terminated in pitiless massacres of the conquered. They likewise tell us why certain peoples have been colonizers, and how they have been able, naturally, if they were of the race of the conquered, or by respecting their customs and creeds if they were of a different stock, to maintain their authority over distant nations.

A question has arisen as to whether the steady advance of man tends to equalize races, or to differentiate them more and more. To it we have to answer that the upper level of civilization is always ascending; but by this fact itself, and since there are always nations at the lowest step, the gulf between them and the higher races is constantly growing deeper. There is progress, it is true, even in the most backward groups. But the law of this

progress gives it an accelerated march as it advances. The superior races are now developing themselves by giant steps, while the others still demand the long ages which our ancestors traversed in order to reach the point where we are now. And when the inferior races reach that point, where shall we be? Farther from them, without doubt, than we are now, unless we shall have disappeared. The evident conclusion then is, that as human races become civilized they tend to greater differentiation rather than to an approach to equality. Civilization not being able to act equally on unequal intelligences, and the most developed necessarily profiting more than those who are less so, it is easy to see that the difference between them will increase considerably in each generation.* It increases all the more because the division of labor, condemning the lower strata to a uniform and identical work, tends to destroy all intelligence in them. The engineer of our days, who composes a new machine, needs much more intelligence than the engineer of the last century; but the modern workman requires much less intelligence to make the detached piece of a watch, which he will keep on making all his life, than his ancestors had to have to make the whole watch.

These considerations do not rest on theoretical reasonings alone. We some time ago fortified them also by anatomical arguments. Studies of the skulls of human races have shown us that while among savages the heads of different individuals vary but little in their dimensions, the differences in our civilized societies are formidable. From the upper to the lower ranks of society the anatomical gulf is as immense as the psychological gulf, and the advance of civilization is constantly making it wider. Since, then, the differences among men of the same race become more and more extended as the race rises in civilization, we conclude that the higher the civilization the more considerable will be the intellectual diversities among individuals of the race. No doubt the mean level will also rise.†

* Theoretically, the differentiation between individuals should follow a kind of geometrical progression, and consequently accentuate itself with extreme rapidity. It is, however, less rapid than the theory indicates. The reason of it doubtless lies in the observed fact that the families of superior men—scientific and literary men, artists, statesmen, etc.—seldom endure. Their descendants disappear rapidly by degeneration, or at least soon return to the crowd. There seems to be a mysterious law constantly tending to eliminate or reduce to the mean intellectual type of a race all the families which depart very greatly from it. This is so, perhaps, because a superiority in one direction has to be acquired at the cost of an inferiority, and consequently a kind of degeneracy, in another. A great man is most frequently an ill-balanced man; and cerebral unbalancing, however little accentuated it may be, is as hard to perpetuate by reproduction as an anatomical monstrosity. Societies also seem condemned, like individuals, not to pass a certain level.

† Most of the thoughts embodied in this article, especially the theory of the progressive differentiation of races, individuals, and the sexes with the advance of civilization, are the

The study of all civilizations proves, in fact, that all progress has been accomplished by a small number of the higher minds. The mass has done nothing more than profit by the advance; it does not even like to see it extended, and the greatest thinkers or inventors have often been martyrs. Yet all the generations, the whole past of a race, bloom out in these fine geniuses. They do not appear by chance or miracle, but represent a long synthesis. To favor their birth and growth is to favor the birth of a progress by which all mankind will be benefited. If we should allow ourselves to be blinded by our dreams of universal equality, we should ourselves be the first victims of it. Equality can only exist in inferiority. To bring about a reign of equality in the world, it would be necessary gradually to pull all that gives value to a race down to the level of what in it is lowest. It would require ages to raise the intellectual level of the lowest peasants up to that of the genius of a Lavoisier, while a second and the stroke of the guillotine is sufficient to destroy such a brain. But while the part of superior men in the development of a civilization is considerable, it is not quite what it is generally believed to be. Their action, I repeat, consists in synthetizing all the efforts of a race; their discoveries are always the result of a long series of prior discoveries; they build an edifice with stones which others have previously hewn. Historians fancy they must couple the name of a man with every invention; yet, among the great inventions which have transformed the world, like those of printing, gunpowder, and electric telegraphy, there is not one of which it can be said that it was created by a single man.

Of similar character is the part which great statesmen have played. They could without doubt destroy a society or disturb its evolution, but it is not given to them to change its course. The genius of a Cromwell or a Napoleon could not perform such a task. Great conquerors might destroy cities, men, and empires by sword and fire, as a child could burn a museum filled with treasures of art, but this destructive power should not subject us to illusions respecting the grandeur of their achievements. The work of great political men is durable only when, like Cæsar or Richelieu, they direct their efforts according to the demands of

result of my own researches. The reader who may be interested in the subject will find them developed in the following works, or memoirs, which have been published at different times: "Recherches anatomiques et mathématiques sur les Lois des Variations du Volume du Crâne" (*couronné* by the Institute and by the Anthropological Society of Paris); "Étude de 42 Crânes d'Hommes célèbres de la Collection du Muséum de Paris" (Bulletin of the Anthropological Society of Paris); "L'Homme et les Sociétés, leurs Origines et leur Histoire," vol. ii; "De Moscou aux Monts Tatras, Étude sur la Formation d'une Race" (Bulletin of the Geographical Society of Paris); "L'Anthropologie actuel et l'Étude des Races" ("Revue Scientifique"); "La Psychologie comme Élément de Classification des Individus et des Races" ("Revue Philosophique").

the moment; the true cause of their success is, then, generally long anterior to themselves. The really great men in politics are those who anticipate the demands that are going to arise, the events for which the past has prepared, and point out the way to be followed. They, also, like the great inventors, synthetize the results of a long previous work.

Of what, in the eye of philosophy, is history, as the books tell it, composed, except of the long recital of the struggles endured by men to create an ideal, adore it, and then destroy it? And have such ideals any more value in the eyes of pure science than the mirage of the desert? There have been, however, great enthusiasts, creators of such mirages, who have profoundly transformed the world. They still from their tombs hold the minds of multitudes under the sway of their thoughts. While not mistaking the significance of their achievements, let us not forget that they would not have succeeded in accomplishing what they did if they had not unconsciously incarnated and expressed the dominant ideal of their race and their time.

It is, in fact, ideas, and consequently those who incarnate them, that lead the world. They rise at first under vague forms, and float in the air, gradually changing their aspect, till some day they appear under the form of a great man or a great act. It is of little account, as determining the force with which they shall act, whether they are true or false. History teaches us that the most chimerical illusions have excited more enthusiasm among men than the best demonstrated truths. Such illusions are only shadows, but nevertheless have to be respected. Through them our fathers were hopeful, and in their heroic and heedless course they have brought us out of barbarism and led us to the point where we stand to-day. Mankind has expended most of its efforts, not in the pursuit of truth, but of error. It has not been able to reach the chimerical aims it was pursuing; but in pursuing them it has realized a progress that it was not seeking.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

MR. GARDINER G. HUBBARD shows a good record, in his presidential address to the American Geographical Society, of American contributions to the extension of geographical knowledge. Our country "has contributed its quota of martyrs in the frozen North, and has led the way into the torrid regions of Africa." It has laid the foundations of the new science of the geography of the sea, by the discoveries of its explorers in ocean currents, the topography of the sea-bottoms, and deep-sea life, in which Americans were first to engage. "The exploring vessels of our Fish Commission have discovered in the deep sea, in one single season, more forms of life than were found by the Challenger Expedition in a three years' cruise." We have also led the way in founding the "geography of the air," or the science of storms, etc., and are still keeping at the front.

THE STONE AGE IN HEATHEN SWEDEN.

By W. H. LARRABEE.

ONE of the peculiar features of modern historical study is that it is to a very large extent dependent upon the examination of the monuments which the people of the past have left and the articles of use and ornament that are found among their ruins. When the nations constituting objects of research were civilized and had writing, as in Egypt and Mesopotamia, the information afforded by these relics is extremely valuable, and furnishes records of events and illustrations of the life of the peoples more definite and accurate than can be obtained from books. The accounts and pictures they bear were a part of the contemporary life, and have such a relation to written history as in the eye of law courts the evidence of the *res gesta* has to a minute made up after the event. With peoples who had not writing and arts, the relics give hardly any evidence respecting events, and only scanty and incoherent testimony of the conditions of their life. The further back we go in the investigation the less satisfactory does the knowledge imparted by them become. But they are all that we have by which to inform ourselves respecting the life of primitive man.

Relics of human life antedating all written monuments have been found in nearly all countries where the search has been carried on by excavation, and often occur superficially where they can be seen without particular search. The investigation of such relics has been made most systematically in the Scandinavian countries, and it was there that the division of prehistoric times into three periods was first made. Thus in Sweden the use of iron was universal in the ninth century A. D., and had been so for a long time. Investigation of the antiquities of the country has shown that previous to the Iron age there was another long time when iron was not known, and weapons and tools were made of bronze; and that before the beginning of the "Bronze age" the country had been inhabited by people who had not the use of metals, and were obliged to employ such materials as stone, horn, bone, and wood. This was the "Stone age." We can conceive, says the Rev. F. Woods, how incomplete is the evidence respecting the primitive life afforded by these relics of stone and bronze, by reflecting that while furniture, stuffs, and clothes made out of such perishable materials as wood, bone, leather, cloth, etc., formed incomparably the greater part of the belongings of the heathen Northmen, it is "only by an exceptional conjunction of specially favorable conditions" that such materials have been able to survive.

The relics of the Stone age in Sweden, and incidentally in Scandinavia generally, are described, and the testimony they give to the kind of life the people lived is set forth in the first part of Dr. Oscar Montelius's "Civilization of Sweden in Heathen Times" (London and New York, Macmillan & Co.), from which, and the Rev. F. Woods's introduction, the facts and illustrations in this article are derived.

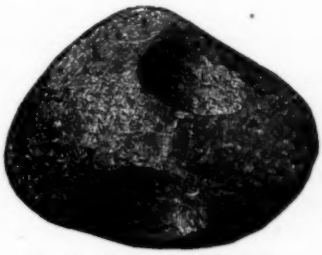

FIG. 1.—HAMMERING-PEBBLE.

FIG. 2.—FLINT ARROW-HEAD.

Our only clew to the antiquity of human settlement in Scandinavia is derived from the evidence afforded by certain finds of a habitation of some southern parts of the region by a people of the Stone age at a time when firs were still the prevailing trees there. Since then the forests of fir-trees have died out and made way for great forests of oaks, "which covered the land till they in their turn succumbed to the now prevailing beech woods."

FIG. 3.—LUNATE FLINT SAW.

Traces of population at a somewhat later but still very early date are found in the "kitchen-middens"—enormous collections of shells, with bones, bearing marks of having been eaten from, and remains of fireplaces and instruments—which are scattered along the sea-coasts.

FIG. 4.—POLISHED GRINDSTONE, WORN BY USE.

The tools with which the Northmen during the Stone age produced their wooden works, and which are found at their old resorts, were mainly knives, saws, borers, chisels, and axes or hatchets. They were made out of flint, chipped into shape by

stone hammers, of which many specimens have been found. Sometimes hollows were cut or ground out in the hammering-pebbles (Fig. 1), in order to secure a firmer grip for the fingers. The manner in which such a pebble could be used for the work was demonstrated to an Englishman some time ago by an Indian arrow-maker in California. The long and narrow barbs in the fine arrow-heads (Fig. 2) and saw-teeth (Fig. 3) were obtained probably by the pressure of a bone tool, such as is still used by some American tribes. Holes were bored, where needed, by twirling a stick, hard pressed upon, against the spot where the perforation was to be. It took a long time, but primitive men had time. Most of the tools were only chipped, while others were polished or ground. The grind-stone was usually a suitable block of sandstone, or else a thick piece of the same material. One of these pieces, which has been worn down in the middle by use, is represented by Fig. 4. Handles, if the instruments were provided with them, were inserted into

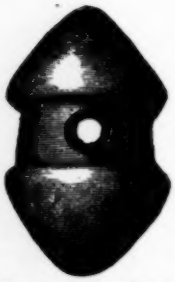

FIG. 5.—AMBER BEAD.

FIG. 6.—BONE FISH-HOOK.

FIG. 7.—DOLMEN AT HAGA, ON THE ISLAND OF ORUST.

holes bored by the tedious process which we have mentioned, or were attached in grooves by splitting the end of a stick and binding it around by cords. Clumsy implements these, even at the best, but some beautiful works remain that were executed with them; and a Danish gentleman recently, for experiment, had some trees felled and all the work necessary for building a small

house, with doors and windows, carried out exclusively with axes and other implements of flint.

At first the people are supposed to have made such clothes as they wore of skins and hides; at a later period they became acquainted with woven stuffs of wool; and the lake-dwellers of Switzerland cultivated flax. For ornaments they had beads of amber (Fig. 5), the teeth of animals, and articles of bone. Awls and needles were made of bone, and an instrument resembling a comb, made of the same material, is supposed to have been used, just as instruments of the kind are employed by the Eskimos, in cutting out the leather threads for sewing. Fishing and the chase supplied the chief means of subsistence, and probably, during the earlier part of the period, the only means. Hooks (Fig. 6) were made of bone, or of bone with the point and barb of flint. Harpoons

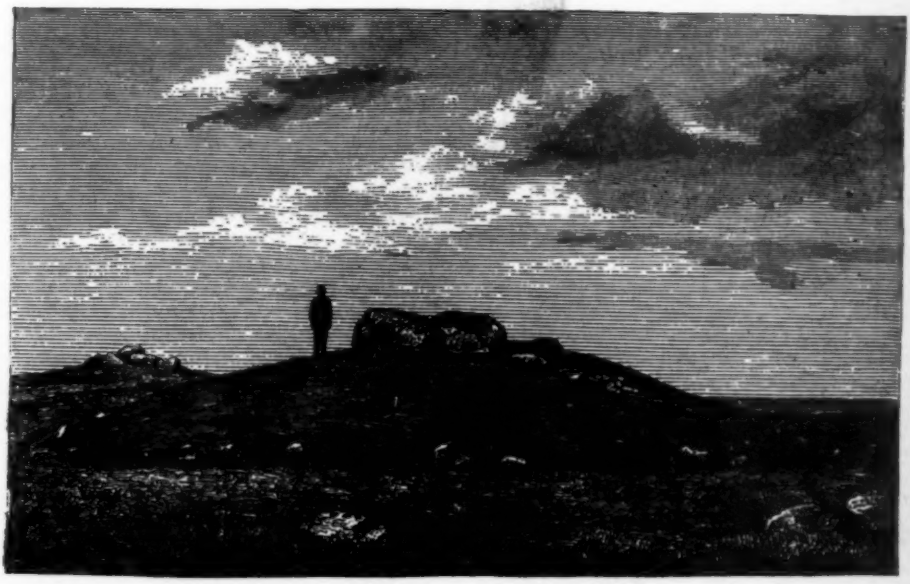

FIG. 8.—TWO PASSAGE-GRAVES AT LUTTRA.

and fishing-spears were also in use, and the lake-dwellers had nets. The people had boats, for remains of fish that can only be caught in deep-sea water have been found in the middens. The earliest boats were probably "dug-outs," though none of those now known can be referred to the Stone age. Domestic animals were kept, for their bones have been found in the passage-graves. The Swiss pastured their cattle and tilled the ground, raising flax, three sorts of wheat, and two-cornered and six-cornered barley. We have no direct proofs of tillage in Sweden during the Stone age, but certain facts seem to show that it was not unknown to them; and this view has been confirmed by the discovery of a stone hand-

mill belonging to the period. Caldrons of clay have holes bored in the upper part, by which the vessel was probably hung over the fire for cooking. Vessels were decorated with straight lines. A horn axe assigned to this period bears two engraved representations of animals.

Except the pile-houses of the Swiss lakes, we know nothing of the dwellings of the Stone age. Prof. Montelius thinks the conjecture is allowable that the people lived in tents made of hides, or in hovels of wood, stones, and turf. Prof. Nilsson has traced a resemblance in form between what are called the "passage-graves" of Scandinavia and the homes of the arctic races in America and Europe. That the Stone-age men had fixed dwelling-places "appears from their often magnificent tombs, which seem to point to the beginning of an organized society, and the combined industry of a small community or of a whole tribe." These tombs are described as "dolmens" (Fig. 7), "passage-graves" (Fig. 8), and "stone cists" (Fig. 9). Of these, the dolmens were the earliest; the passage-graves are a little later; the

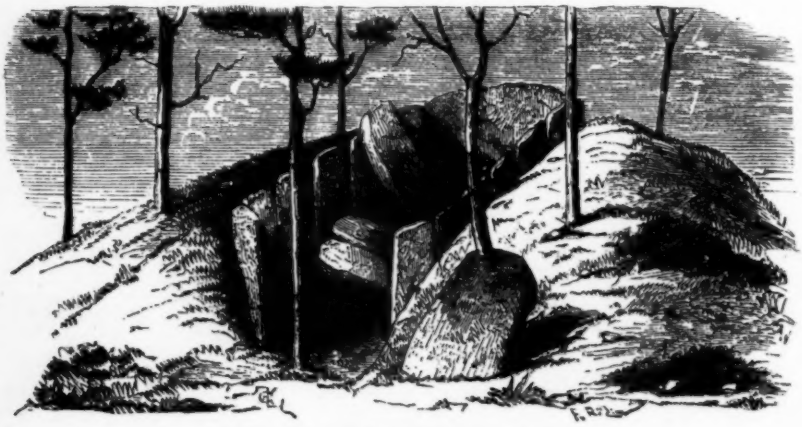

FIG. 9.—STONE CIST NEAR SKOTTENED.

uncovered stone cists are later still; and the cists covered with a barrow belong to the time of transition between the Stone and Bronze ages.

"During the Stone age," says Prof. Montelius, "bodies were always buried unburned, in a recumbent or sitting position. By the side of the dead body was usually laid a weapon, a tool, or some ornaments. We often find in graves of this period earthenware vessels, now filled only with earth. The care bestowed upon the last resting-place of the departed certainly betokens a belief in a future life; but the things placed by the side of the dead seem to show that that life was believed to be merely a continuation of the life on earth, with the same needs and the same pleas-

ures." Offering-stones, with little cup-shaped holes, are sometimes found on the roof-stones of graves of the Stone age. They are now popularly called "elf-mills," and are still regarded as holy; and, it is said, offerings are still secretly made in them.

That the Stone age lasted for a very long time in the North is proved, among other things, by the fact that this period reached a far higher development there than anywhere else in Europe. At what time it began in Sweden we can not even approximately determine; but everything seems to show that it ended rather before than after 1500 B. C., and, therefore, about three thousand five hundred years before our time. In many countries of the east and in the south of Europe the Stone age came to an end long ago; while in some parts of the New World this stage of civilization has continued to our own day.

ELECTRICAL WAVES.*

By SAMUEL SHELDON, Ph. D.

SINCE the time when Maxwell occupied himself with the theory of electricity, perhaps even since the time of Faraday, it has been generally accepted by most physicists that electricity is a phenomenon resulting from oscillations of the luminiferous ether. However, with the exception of a few experiments on inductive capacities, etc., instigated by Maxwell's "electro-magnetic theory of light," no direct experimental verifications of this hypothesis had been made until the latter part of last year, when Prof. Hertz, of Carlsruhe, Germany, commenced a series of experiments on the interference of electrical waves. In all, six articles have been published—two in Band 31 and four in Band 34 of the "Annalen der Physik und Chemie." The earlier articles are of a qualitative character, while the later are quantitative. The former are of less interest than the latter, because the phenomena are less striking and are not so decisive as a proof. They are substantially as follow: The secondary electrodes of a large Ruhmkorff coil consist of two brass rods whose ends are surmounted with brass balls. The two rods are in the same straight line, and separated from each other by a short air-space of about seven millimetres in length. This is the general form of discharger in a Ruhmkorff. From either of these electrodes is led a wire, which connects with a rectangularly bent wire, which, however, is not completely closed, but is cut in some portion, and each of its ends surmounted by brass balls.

* Read before the Mathematical Physical Club of Boston and Cambridge, December 17, 1888.

If, now, the Ruhmkorff be excited, the following phenomena result: If the point of contact between the conducting wire and the rectangle be moved along the latter, it will be found that, for most places, a spark passes between the balls of the rectangle, which varies in intensity, and at one place entirely disappears. This place, if we suppose the opening in the rectangle to be in the middle of one end and both balls to be of the same size, is in the middle of the other end. If, now, while no spark is passing in the rectangle, an insulated conductor be brought into connection with either ball, the sparks again appear. These, again, may be caused to disappear by moving the point of contact toward the manipulated terminal. The same effect would also be produced if, instead of changing the point of contact, an equal insulated conductor were touched to the other ball.

The length, resistance, and quality of the conducting wire have no influence upon the sparks; neither does the resistance or material of the rectangle affect it noticeably: e. g., one half of the rectangle being made of thick copper wire and the other of very fine German-silver wire did not alter the phenomena. Another conductor being brought in contact with the joint between the conducting wire and the rectangle has no influence.

The size of the rectangle has a great influence upon the size and length of the spark between its terminals; the larger giving, within certain limits, always the longer spark.

The air distance of the Ruhmkorff discharger is of great importance; under five and more than fifteen millimetres proved to be infelicitous.

Hertz's explanation of these phenomena is the following: At the moment when a discharge takes place between the terminals of a Ruhmkorff coil, in the whole circuit, and in all conductors in contact with it, powerful wave disturbances are agitated, which follow each other in such infinitesimal portions of time that the time which is required to travel with enormous velocity even a short wire is appreciable. These waves, arriving through the conducting wire at the rectangle, divide and traverse simultaneously both branches. If both sides are electrically symmetrical, the two wave-branches arrive at the balls of the rectangle in exactly the same phase, but oppositely directed, and interfere; there can then be, of course, no spark. If, however, they are not symmetrical, as when the contact is not in the middle, they do not interfere totally, but a spark passes. As the contact moves around the rectangle, the spark at its terminals will be less or more powerful as the interference is more or less total.

The electrical symmetry depends not alone upon the length of the wire, but upon its self-induction coefficient and its capacity.

The formula which expresses the relations is one from Lorenz ("Annalen der Physik und Chemie," vii, p. 161):

$$T = \frac{\pi\sqrt{PC}}{A},$$

where T = time of oscillation of the electrical wave, P = the self-induction of the conductor concerned, C = its electrostatic capacity, and A = velocity of electrical propagation, which is assumed to be that of light. It will thus be seen that each conductor has its own proper time of electrical oscillation and wave-length.

If, now, the capacity of one side of the rectangle be increased, the time of oscillation of the waves on that side will be also increased. This will increase the wave-length, and equilibrium can be established by adding the same capacity to the other side, or by changing the point of contact.

For the reason that the only variables in the time of oscillation are the self-induction and the capacity, the resistance and material of the rectangle have no influence on the phenomena. Because the capacity of each half of the rectangle is chiefly that of the balls at its terminals, the employing of fine wire for one half can produce no noticeable effect.

That the size of the rectangle should have such an influence is to be expected up to certain limits—that is, until the total length of the sides is one wave-length or a multiple of the same. Then the waves could be made to arrive at the terminals in opposite phases, and would give the largest sparks.

Were this the only proof which Hertz could give of interference, a great deal of doubt might be cast upon its conclusiveness. Would not one naturally expect that, if both sides of the rectangle were of the same length and had the same capacity, the potential on both balls would be the same, and no discharge could take place; or, when of different capacities, the charging and discharging following each other so rapidly that the same quantity of electricity would tend to pass through a section of each side of the rectangle, and would thus necessitate a discharge?

But Hertz's quantitative experiments are more satisfactory. In order to understand them, a few preliminary phenomena must be described. These relate to what he calls the principle of "resonance." As any sound resonator, having its own proper wave-length, can be set in vibration by a vibrating body of the same or multiple time of vibration, so we might suppose that any electrical conductor could be set in vibration by a neighboring electrical wave disturbance of proper time of oscillation. This supposition is verified by experiment.

The apparatus and arrangement are very similar to those in the previous experiment. However, instead of the two outer brass balls on the Ruhmkorff discharger, two hollow zinc spheres of

thirty centimetres diameter were substituted, and these were movable along the rods. As these constitute the electrical ends of the discharger, the same may be altered in length by the total diameter of each by simply letting the rods project into the cavity of the spheres. The time of oscillation of the waves in the Ruhmkorff can thus be altered. The brass balls of the rectangle were provided with a micrometer adjustment, so that the length of spark which passed might be measured. The connecting wire was in these experiments dispensed with, and the rectangle was mounted on insulators in front of the Ruhmkorff discharger.

With this arrangement Hertz carried out a complete set of observations, in each of which the effect of a regular series of changes in one of the variables was investigated—e. g., the time of oscillation of the primary discharger would be regularly increased by changing the capacity or self-induction, and for each change the length of spark in the rectangle would be measured. One series in detail will suffice for our purpose.

Suppose, at the beginning of the experiment, that the time of oscillation of the rectangle is smaller than that of the Ruhmkorff discharger, and the spark is one millimetre long. If now we hang two hooks of wire on each ball of the rectangle, the capacity is increased, and we get a spark of three millimetres. Add two more equal hooks, and the spark is five millimetres. Add two more, and it falls off to three millimetres again. If this process be continued, the spark will alternately reach a maximum and minimum, and the natural inference is that the time of oscillation of the rectangle is nearest that of the Ruhmkorff discharger when the spark in the former is at a maximum.

Perhaps it is most striking to place the micrometer at the maximum spark distance, and then, by constantly changing the capacity of either conductor, cause the spark to disappear and reappear. Should small spheres be used, instead of wires, for changing the capacity, we would then have a direct means of determining the wave-length.

These sets of experiments led Hertz to conclude that the principle of resonance is as true for electrical waves as for sound waves, and he employs it for his quantitative work.

The arrangement of apparatus is as follows: To the outer ends of the Ruhmkorff discharger are attached two plates, whose planes are vertical and embrace the line of direction of the discharger. Back of one of these is mounted on an insulated stand a similar plate of the same size. A wire leads from the inner central edge of this to a point on a level but just back of the air-space of the discharger. It then turns in a curve to a point about thirty centimetres directly over the discharger, and then continues in a straight horizontal line some sixty metres. The end is left free,

and, if now the Ruhmkorff be excited, a series of stationary electrical waves will be formed in the wire. To detect these we employ the principle of resonance. A wire whose time of oscillation has been determined and found to be nearly equal to that of the primary conductor is bent into a circle, and the ends are brought close together. This is then brought close to the long wire, and held so that its plane embraces the latter. A fine display of sparks will be seen to accompany the Ruhmkorff discharge.

If this proof circuit be approached to the extreme end of the long wire, no sparks will be seen. The wire has at its end, in fact, a node the same as a stopped organ-pipe has. As the air in the pipe is undisturbed, so the potential of the wire end is unchangeable. As we recede from the end, the sparks grow longer, but finally disappear again. Here is another node. We measure the distance between the two and cut the wire so that its total length shall be a multiple of this length, and then we proceed to find all the nodes, and mark them by paper riders. If we measure each of these distances and take the mean, or measure the whole length of the wire and divide by the number of nodes, we have a value for the wave-length of the conductor. In Hertz's experiment this value was 2·8 metres. From this value, and the time of oscillation reckoned from the self-induction and capacity, he gets the velocity of propagation of electrical disturbances as two hundred thousand kilometres per second. This result Hertz prints in bold-faced type, and puts it as a climax of all his work. This is truly wonderful. If we consider that the calculated value of the time of oscillation depends upon the assumption that the velocity of electrical wave propagation is the same as that of light (three hundred thousand kilometres per second), and this circuitous calculation of the same thing gives two hundred thousand kilometres per second, we can hardly give Hertz the credit of extremely accurate work. However, Hertz has made a great advance in physical science. Since Weber introduced the absolute system of units, no great advance has been made. Physicists have busied themselves in measuring the various constants, in refining and perfecting the methods of measurement, or in applying principles already known to technical and practical purposes. Hertz, however, has opened a new and unexplored field, which must eventually bring us into a closer acquaintance with the mysteries which we are daily manipulating.

This series of experiments has excited a great deal of attention in English physical circles. Prof. Fitzgerald, of this department of the British Association, laid great emphasis, at the last meeting, on the advance which had been made. Oliver Heaviside has justified his patronymic by publishing a complex mass of mathematical formulæ on the subject. He considers that the waves of

Hertz are of a much more complex nature than the experiments would leave one to infer.

When we remember the effect which electricity has upon the plane of polarized light, it would seem that Hertz's wave-lengths are of an entirely different order from what they should be. How can electrical wave-lengths of one metre be in any way associated with light-waves of less than one billionth of a millimetre? Whatever we have known of the wave lengths of the ether, in radiant heat and light, has always been of that infinitesimal order. Still, should the velocity of propagation of electrical waves be much greater than has been supposed, then with these large wave-lengths the times of oscillation could be of the same order as those of light.

Hertz, however, has a system of stationary waves, and it would seem that no direct calculations could give a correct value for the time of oscillation. This can be shown by moving a long trough of water. By holding one end in the hand, suitable impulses can be given so as to produce any desired wave-lengths. Should Hertz be wrong in his conclusions, still the impulse which he has given in this direction is sure to fructify. It is possible that induction may be found to be a phenomenon of pure wave-motion, and that it can be likened directly to radiation. Could we then carry the comparison still further, and say that a conductor is an opaque medium; that a dielectric is transparent—then we would likely soon be constructing electrical lenses, would be detecting electrical refraction, diffraction, and possibly be constructing an electrical spectrum. Doubtless, if not this, some similar thing will develop, and no young physicist need then say that all the things in physics have already been discovered and measured.

THE WASTES OF MODERN CIVILIZATION.

By FELIX L. OSWALD, M.D.

I.

VARNHAGEN von ENSE, the German Macaulay, characterizes the shams of our latter-day civilization in the remark that "a constant improvement in the luster of the varnish has kept up with the progressive dry-rot of the timber."

The historian thus denounces the increasing political corruption of his age, but his aphorism admits of a much wider application. The increase of prudery masks the decadence of the virtue it tries to simulate; modern courtesies of speech too often conceal the baldest egotism; callous inhumanity is glossed over with sentimental cant.

But the justice of Varnhagen's indictment is perhaps most forcibly illustrated in the time and labor saving contrivances of modern civilization, as contrasted with the enormous waste incident to the evils of life under abnormal circumstances.

The apparent shiftlessness of animals and savages is often due to their confidence in the spontaneous bounty of Nature. Apes will nibble and fling away dozens of wild figs for one they eat, well knowing that the forests will continue to produce millions of similar fruits. Nomads exhaust the pastures of a whole river-delta, and then drive their herds farther inland, having found by experience that, before the return of spring, the coast-land meadows will have recovered their luxuriance.

We pity the ignorance of the Circassian peasant who wastes his time and energy by plowing his highland farm with an implement resembling a crooked fence-rail; but together with other old-fashioned things that barbarian has retained his primitive confidence in the trustworthiness of his natural instincts, and consequently devotes every square yard of his field to the production of palatable and nutritious vegetables.

"Whatever is natural is wrong," was for centuries the shibboleth of our spiritual taskmasters, and that doctrine has borne its fruit in the reckless disregard of our natural intuitions. The shocking taste of a poisonous weed or liquid is generally accepted as a *prima facie* proof of its wholesomeness, and many millions of acres, plowed and harrowed with highly improved apparatus, are wasted on the production of not only useless but positively pernicious harvests. Our prohibition orators bewail the vast area of arable soil wasted on distillery crops, but in the eyes of science the alcohol-habit is only a special form of the stimulant-vice, which, in the course of the last fifty years, has assumed more gigantic proportions than in the most bibulous era of pagan antiquity. The official statistics of the liquor traffic generally allow one bushel of grain for two gallons of spirits, and three bushels for one barrel of beer. By that estimate, the distilleries of the United States alone consumed in the last few years an annual average of thirty-five million bushels of grain, the breweries at least twenty millions. The aggregate of that wasted farm-produce would have made more than a billion four-pound loaves of bread, or nearly a hundred loaves for every household in North America. Placed side by side, the bushel-measures containing that grain would form a chain equal in extent to the circumference of the earth. But the area of the land thus "tilled to bring forth a harvest of misery, crime, and disease" is only a fraction of the total portion of arable fields cultivated to subserve the various forms of the stimulant-vice. Tobacco, tea, coffee, pulque, and opium, together with all the toxic stimulants prepared from tree-

fruits and edible roots, devour the toil of many million laborers and the productive value of at least one million square miles. The fertility of that enormous area is thus not only wasted, but turned from a blessing into a concentration of curses. Mankind, indeed, would gain by the result if the fruitful fields of that poison-harvest were wholly withdrawn from human use; but if even only half their surface were devoted to the production of wholesome food, pauperism would disappear before the blessings of an unparalleled abundance—an abundance far exceeding the prosperity of the happiest provinces of pagan Italy or Moorish Spain. Adding the indirect benefits resulting from the decrease of disease and crime, it is no exaggeration to say that half the weight of human misery would thus be lifted from the scale of weal and woe.

Our political economists would be scandalized by studying the free-and-easy financial methods of ancient empires whose rulers often permitted a large percentage of the public taxes to cling to the pockets of ill-controlled collectors; but the live-and-let-live carelessness of those potentates was associated with a belief in the justice of the general claim to earthly happiness, and the evils of absolutism were mitigated by the liberality of the absolute Cæsars. Every city of the Roman Empire had its free wrestling-ring and foot-race course; every provincial metropolis a free circus, with accommodation for many thousand spectators. Free baths were thought as indispensable as free public fountains of pure drinking-water. Holidays were multiplied to satisfy the needs of an increasing population deprived of the rustic sports of their ancestors. Every community had its weekly and monthly festivals. In Greece even the hostilities of civil wars were suspended to insure free access to the plains of Corinth, where the Olympic games were celebrated with a regularity that made their period the basis of chronological computation for a space of nearly eight hundred years. When Rome became the capital of the world, the yearly disbursements for the subvention of free public recreations equaled the tribute of a wealthy province. As a consequence, discontent with the rule of such autocrats was so rare, that the peace of an empire equal in extent to the entire area of modern Europe could be preserved with a standing army of less than one hundred thousand men.

The modern alliance of canting hypocrisy and bullying despotism has tried a different plan. Enjoyments are reserved for aristocrats by the grace of the orthodox Deity, while the worship of sorrow is enforced on millions of toilers, whose desire of recreation is suppressed as a revival of impious worldliness. The Cæsars silenced the clamors for liberty with free bread and free circus games; the Czars silence them with the knout; but those cowed victims of knout and cross can not be expected to die in

defense of their oppressors; and the conscious impossibility of relying on the enthusiasm of volunteers obliges every ruler of fifty faithful square miles to surround his throne with a bulwark of dehumanized machine soldiers, who, in obedience to the mandate of the uniformed chief machinist, would shoot their own fathers or bayonet their own children. A territory which once could be easily managed with twenty legions, each of four thousand men, has now to be bullied into submission by standing armies aggregating from five million and a half to six million conscripts. The expenses of maintaining that apparatus for the perpetuation of orthodox despotism cost the nations of Europe a minimum of $625,000,000 a year, and withdraw from agriculture an amount of labor which otherwise would suffice to support her population in spite of intermittent droughts.

Our elaborate code of by-laws for the suppression of holiday recreations can still be circumvented by the resources of opulence, and the well-known hopelessness of any other expedient has stimulated a race for wealth which does not hesitate to attain its object at any risk of social or sanitary consequences. The number of infants which the superstition of the Ammonites sacrificed to Moloch is a mere trifle compared with the multitude of children now devoted to a far more cruel fate by being literally drudged to death in crowded factories to enable a millionaire to save a few dimes on his weekly pay-roll and add a few per cent to the exorbitant rate of his yearly profits. In times of general scarcity the market has been drained of its scant supplies by speculators trying to coin gain from the distress of their fellow-men and risking, after all, to be foiled by the decay of their hoarded stores or their destruction by fire or flood. Quack nostrums, which not one intelligent man in a hundred would privately hesitate to pronounce infinitely worse than worthless, are sold by ship-loads and car-loads to disseminate disease and the seeds of the stimulant-vice, and the saints who contribute thousands to insure the theological soundness of the Quaggalla Hottentots do not care enough for the physical health of their own countrymen to whisper a word against the lawfulness of the infamous traffic.

Nearly two thousand years ago Pliny and Columella denounced the folly of destroying the highland forests that shelter the sources of fertilizing brooks and the nests of insect-destroying birds. "Sacred groves" were not limited to the land of the Phœnicians. The Celtic and German Druids protected the forests of their native lands; and even the barbarous Huns seem dimly to have recognized the climatic influence of arboreal vegetation, since we read of their chiefs enacting laws for the protection of the mountain-woods in the lower valley of the Danube.

The mediæval reign of Antinaturalism, however, inaugurated

that reckless destruction of forest-trees which by its consequences has turned many of the most fruitful regions of ancient Europe into almost irreclaimable deserts. Rational agriculture became a tradition of the past; the culture of secular science was fiercely denounced from thousands of pulpits; improvidence, "unworldliness," and blind reliance on the efficacy of prayer were systematically inculcated as supreme virtues. A warning against the consequences of that infatuation would have been answered by the prompt anathemas of the miracle-mongers; but it would be a mistake to suppose that their rant imposed on any independent thinker, even of that ghost-ridden age. "When I consider the value of the least clump of trees," says Bernard Palissy, a persecuted dissenter of the sixteenth century, "I much marvel at the great ignorance of men, who, as it seems, do nowadays study only to fell and waste the fair forests which their forefathers did guard so carefully. I would think no evil of them for cutting down the woods, did they but replant again some part of them; but they care nothing for the consequences of their wastefulness, nor do they reck of the great damage done to their children which come after them." ("Œuvres complètes de Bernard Palissy," p. 88.)

The folly of the insane bigotry which left such protests unheeded was only too soon demonstrated by its natural consequences. When the highlands of the Mediterranean peninsulas had been deprived of their woods, the general failing of springs turned rivers into shallow brooks and brook valleys into arid ravines, which at last ceased to supply the irrigation canals by which the starving farmers hoped to relieve their distress. Vast tracts of once fertile lands had to be entirely abandoned. And while the summer droughts became more severe, winter floods became more frequent and destructive. The steep mountain-slopes, denuded of their vegetable mold, sent down torrents of snow-water, turning rivers into rushing seas and inundating their valleys in spite of protecting dikes. Hill-sides which once furnished pastures for thousands of herds were torn up by ever-deepening ravines and reduced to a state of desolation as complete as that of a volcanic cinder-field. Harbors once offering safe anchorage for the fleets of an empire became inaccessible from the accumulating deposits of the diluvium which had been swept down from the torrent-rent mountain-slopes, while a detritus of coarse sand and gravel covered the fields of the intermediate valleys.

On the shores of the Adriatic alone 250,000,000 cubic yards of highland soil are thus yearly deposited in the form of pestilential mud-banks. A million square miles of uplands in southern Europe and western Asia have become almost as arid as the mountains of the moon. The Rhône, the Loire, the Ebro, the Guadalquivir, the

Euphrates, and the Orontes have completely depopulated many districts exposed to the devastations of their yearly floods.

In America the same cause has begun to produce the same effect. Not in Mexico alone, but within the boundaries of our own republic, the progress of reckless forest-destruction has made inundations an annual calamity, and has so impoverished the soil of the denuded area that extensive tracts in the terrace-lands of the southern Alleghanies now resemble the *despoblados* of worn-out Spain. The loss resulting from the consequences of that improvidence far exceeds the benefit of labor-saving machinery—so much so, indeed, that the waste of vegetable mold, in our Eastern cotton States alone, more than outweighs the profit derived from the improvement of all agricultural implements used on this continent.

HOME-MADE APPARATUS.

By JOHN F. WOODHULL,

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IT is a duty every teacher owes to his pupils to explain to them, or help them to find out for themselves, the causes of the natural phenomena which occur daily before their eyes. Yet to undertake to teach pupils about natural objects without allowing them to *see, handle, hear, taste,* or *smell* them—i. e., to come in contact with them by means of their senses—is like trying to teach music to a man who was born deaf, or color to a man who was born blind. Although it is pretty generally conceded that the teaching of the physical sciences *ought* to be accompanied with illustrative experiments, it is rarely done in the public schools, even in the larger high schools.

The science teacher in the public schools appears to be in a state of mind which might be described as hopeless. He knows that it is idle to look for well-equipped laboratories in the public schools. He knows, also, that even if he could hope for laboratories and apparatus, he certainly can never expect a course of study which will permit of sufficient time for laboratory work. Therefore, finding it wholly impracticable to carry out his convictions, he is in a state of hopelessness. He despairingly falls into the old way of assigning lessons from the text-book. Subjects so full of interest as the natural sciences are thus converted into useless drudgery.

The problem is, *How shall we make it practicable to teach science in the public schools experimentally?*

The first difficulty in the solution of this problem is that school

boards have not the means wherewith to purchase apparatus to any great extent. This fact has led some firms to manufacture what might be called *demonstration* apparatus, much cheaper and simpler in construction than that hitherto used, and therefore vastly superior for illustrating principles, although not sufficiently refined for making accurate measurements; like a story told for illustration by a public speaker, short and to the point, but not embellished so much as to divert the mind from the argument. This is a step in the right direction, but it does not solve the problem. The apparatus is still so expensive that it will be a long time before school boards will be able to purchase it.

Driven by necessity, therefore, which frequently proves to be the mother of invention, the teacher must seize upon familiar objects which chance to be at hand, and, with slight changes perhaps in their construction, use them as apparatus with which to illustrate the principles of his science. Oftentimes he will find that this simple, *home-made* apparatus is far better for illustrating scientific principles than that which has held sway in laboratories for years. Its great merit lies in its simplicity. The student's mind is confused by a complex piece of apparatus. He loses sight of the principle which you would teach in his perplexity to solve the riddle of the machine. Again, this home-made apparatus has special merit in the eyes of the school trustee who sees that with an expenditure of five cents something has been made which usually costs five dollars.

The second great difficulty in the solution of our problem is that school courses, as they are now planned, do not allow adequate time for experimentation. It may seem strange to say that one can make his own apparatus and experiment with it in less time than is required to use the old-fashioned apparatus, and yet we positively and emphatically state this. For example, the principles taught by the so-called "fountain *in vacuo*" are much more quickly illustrated by a bottle with rubber stopper and tubing, as shown in Gage's "Elements of Physics," page 3, Fig. 3. In this case the lungs are used as an *air-pump*. If the same bottle and tubing be arranged as shown in the above-mentioned text-book, page 59, Fig. 40, the lungs may be used as a condenser, and the bottle will supply the place of a *condensing chamber*. Contrivances by which all the experiments may be performed which usually require air-pump and condenser are as simple as those mentioned above. The common-school teacher who has difficulty in securing air-pump and condenser may rejoice in the thought that he has a pair of lungs which may be made to supply the place of both, and are less liable to get out of order. They will not require him to spend his Saturday afternoons in oiling them and fixing valves.

The time required to get ready the old-fashioned apparatus makes it utterly impossible for a teacher in a public school to use it. Again, the time required for the manipulation of it in the class, causes the pupil's mind to wander to other thoughts than that of the principle which is to be illustrated. Add to this the fact that home-made apparatus is so suggestive of scientific principles that, while the student is making it, his mind is constantly learning something new, and we have ground for the statement that *home-made apparatus economizes time sufficiently to make it practicable to teach science experimentally in the public schools.*

Perhaps the chief argument in favor of home-made apparatus is what might be called the manual-training argument—i. e., the argument of its educational value to the student who constructs it. It is always noticeable that the student who makes his own apparatus is not only liable to get a better comprehension of the principles which it illustrates, but his mind is thereby stimulated to inquire into many kindred principles.

The third great difficulty in the solution of our problem is often stated in this way: Teachers in the public schools have not sufficient skill to do this work. The reply is, (1) that it requires less skill to illustrate principles with home-made apparatus than with that which has been the awe and admiration of pupils and teachers alike for ages, and (2) that patience and a love for the work are far more essential qualifications than that which is usually called skill.

To summarize the arguments for home-made apparatus:

1. It teaches the principles better than the cumbersome and expensive forms of apparatus can. Pupils, as a rule, are not machinists and do not understand a complex machine.

2. The student takes a more lively interest in it and understands it better because he makes it himself.

3. All schools may possess it because of the slight expense involved.

4. It is applicable to the lower grades because of its simplicity.

5. It is applicable to subjects which have not hitherto been taught experimentally.

The last argument has special reference to physiology. It has been customary to speak of physics and chemistry as the experimental sciences, but there seem to be equally good reasons why physiology should be taught by experiments also. The processes of respiration, circulation, action of muscles, formation of voice, digestion, and many others admit—nay, demand—illustrative experiments, and the advantages of home-made apparatus are quite as apparent in this field as in the realm of the physical sciences.

THE DEFENSIVE ARMOR OF PLANTS.

By M. HENRY DE VARIGNY.

WHILE, as Darwin and his successors have established, plants are dependent to a considerable extent upon insects for the means of securing the fertilization of their seed, they are also liable to be eaten by them, and are in great danger from the voracious appetites of other animals. They are not, however, wholly without defense against these attacks, but are provided with armors of various kinds, by the aid of which they offer a more or less effective resistance to them. These methods of defense have been the subject of special investigation by Prof. E. Stahl,* of the University of Jena, whose work, "Pflanzen und Schnecken" (June, 1888), presents a most interesting chapter in the history of the vegetable struggle for existence.

While every plant has its enemies more or less numerous and dangerous, the number as a whole is not generally considerable. Some attack the young plant, others the adult; some one part of it, some another. They would, perhaps, be more numerous were it not for the effectiveness of the means of defense that the plant can present against them. These means are various, but without them vegetable species would disappear very quickly. The protection conferred by them is evident, but an enemy more or less is much for a plant. It is sometimes a question of life or death. The phylloxera alone has been competent to destroy the vine in France; and, if ruminants should add their attacks to those of insects against the thyme or euphorbia, those kinds would soon disappear. In some cases, as of thorns or nettles, the armor is easily discovered; in other cases it is internal, chemical, or toxic. The protection is evident, whatever its nature may be. The question arises whether it is fortuitous or the result of a selection among plants. We can hardly doubt what the answer should be. Selection has certainly played a considerable part in the matter.

* Prof. Stahl's study is not the only one that has been made in this line, although it is perhaps the only experimental one. M. L. Erréra, of Brussels, presented a short memoir to the Royal Botanical Society of Belgium in 1886, in which he pointed out how experiments and observations could be carried on in reference to the subject. He drew up a table in which he classified the means of defense presented by plants as follows:—*Biological characters:* Plants at stations not easily accessible or with organs difficult of access, social plants, vassal plants, bullying plants (simulating dangerous species). *Anatomical characters:* Hard, cutting, or piercing organs, calcification, silicification, nettle-hairs, thorns, etc. *Chemical characters:* Acids, tannins, volatile oils, bitter properties, alkaloids, and glycosoids. M. Erréra adds a table of plants known to him which present one or another of the characteristics thus described. But his design was simply to show how great an interest the study might be made to afford. His views are confirmed by Prof. Stahl's researches.

M. Stahl's experiments were made in his own garden and in the woods in the neighborhood, and bore direct reference to the attitude of snails toward the plants. The questions were asked, What plants do snails prefer; what ones do they avoid, and why do they avoid them? The results of his study may be verified by almost any one. Several species of snails were observed; including special feeders, those which live wholly on mushrooms, and omnivorous snails, which, while preferring certain species, eat more or less of all kinds of plants, and sometimes accommodate themselves to animal food.

Pieces of mushroom were offered to the snails, a part of them fresh, others after having been macerated in alcohol, dried by evaporation, and washed. The different species varied in their behavior toward the food. The omnivorous snails would not eat, or would only touch the fresh pieces, but readily devoured those which had been treated with alcohol; but a special feeder ate the fresh pieces and left the others. Hence the author concluded that there exists in the fresh mushroom a substance soluble in alcohol that attracts some animals and repels others. It must not, however, be believed that the special feeders can only live on particular food, for they are capable of accommodating themselves to other kinds when it is necessary. That the ingredient soluble in alcohol was the essential element of the food was proved by the special feeders, which avoided the macerated and dried food, but returned to it when it had been soaked again in the alcohol by which that ingredient had been abstracted.

Some light is cast upon the bearing of this experiment by reflecting on the enormous quantities of food which the omnivorous snails in a state of nature require. A vine-snail or a slug will eat a quarter or a third of its weight of carrot or potato in twelve or twenty-four hours. Although their needs are but slight, they can hardly find enough to assuage their hunger, on account of the mechanical or chemical defenses which most plants offer against them. Thus, the garden snail causes immense destruction of the filbert-leaves in the spring; but it would cause more if these leaves did not contain certain chemical substances, for it eats them more greedily after they have been treated with alcohol. Though this sort of protection is only relative, it will appear very considerable when we reflect upon the abundance and fertility of some species of snail.

Examining a garden near Jena after a warm rain in April, of forty-four snails of the species *hortensis*, *fruticum*, and *arbustorum*, ten were found upon living plants, while the thirty-four others were eating dead leaves. These three species, therefore, most usually attack dead plants. *Helix pomatia*, on the other hand, was observed almost exclusively upon living species. Ex-

periments in which this species, with *Helix hortensis* and *Limax agrestis*, a voracious all-feeder, were put in presence of several plants having strong odors and pronounced flavors, showed that their tastes as toward living plants were very different. These experiments tend to show that the living plants are protected to a greater or less extent by the presence of some constituent disagreeable to the snails, which we may regard as a defensive armor to them. The dead parts of the plants were preferred, although as a rule dried vegetable is less alimentary than fresh, because the disagreeable substance had been removed or weakened by evaporation. Other experiments show that this kind of armor is, as a rule, the most effective.

When a drop of the juice of sorrel, garlic, saxifrage, or nasturtion is put upon the tegument of a snail, the animal manifests pain and exudes abundance of its mucous secretion; yet it is not thus affected by a drop of water. When snails avoid plants marked by such juices, we have a right to regard the plants as defended by a chemical armor. The offensive substance may also be important to the nutrition of the plant, but that is not the question we are dealing with here. Many plants are evidently lacking in this means of defense; for, of some plants, all the animals experimented upon have been found to prefer fresh to dead parts. Others are never touched by them, whether living or dead. Hence we may conceive that an infinite variety may exist in the degrees of chemical armoring between total absence of protection and complete protection.

Plants containing perceptible tannin are disagreeable to nearly all animals. Only swine will eat acorns as if they regard them as food. Other animals reject them, except when they can not get anything else. Leguminous plants containing tannin in weak proportions are eaten by horses and cattle, but snails are not fond of them. But the garden snail, which lets fresh clover alone, will eat it freely after the tannin has been extracted with alcohol. It is also probably tannin that inspires snails with respect for vetches, saxifrage, and stone-crop. Many water-plants, likewise, strong in tannin, are respected by water-snails, while the treatment with alcohol converts them into savory dishes for the same animals. Other plants, like dock, sorrel, and begonia, contain oxalic acid in notable quantities, and are obnoxious to them when too freely mixed with their food. It is worthy of remark that if carrot, of which snails are fond, is soaked in solutions of tannin or oxalic acid, they will avoid it in proportion as it is strongly impregnated with the offensive substance.

Strongly acid substances are often found on the surface of the leaves of plants. M. Stahl casually perceived that a leaf of *Œnothera* caused a very pronounced acid sensation on contact with

the tongue, which was due to the presence of a superficial acid. On examination he found the same property present in other plants of the *Onograceæ* and *Papilionaceæ*. The acid is secreted by numerous one-celled cylindrical hairs. It consists of a mixture of oxalic, acetic, and malic acids, and, being very disagreeable to slugs and snails, constitutes an efficacious protection against their ravages. A simple contact of its tentacles or teguments with the secretory hairs is enough to cause the animal to draw back and go somewhere else to indulge its cravings. But if the leaves are washed, and the hairs cleansed of the acid secretion, they will be eaten at once.

Many plants are furnished with strong and pungent ethereal oils or similar substances. Prof. Tyndall thinks that these essences help to protect the plant against excessive heat. Without disputing this, M. Stahl finds that they are also efficient in defense against animals. This was proved with respect to rue, calamus, peppermint, dictamnus, and crane's-bill; and snails would at once turn out of the way to avoid a crushed leaf of the latter when placed in their road. Bitter leaves were avoided when fresh; when dead, even those of the gentian were relished, although the fresh ones were rejected by very hungry animals. The expressed juices were very disagreeable to them. The bitter was evidently the unpleasant quality, for the plants in question were free from tannin.* The liverworts, according to W. Pfeffer's researches, contain fat substances, the function of which is unknown, but to which Mr. Stahl ascribes a protecting agency. It is certain that, though they are easily accessible to all animals, they very rarely present any traces of having been attacked by them; and land-snails respect them in a very marked manner. Even after fourteen days of fasting, *Helix hortensis* could not resolve to eat the thallus of *Pellia*. But there are genera (*Lunaria* and *Marchantia*) of which the less delicate snails will consent to eat a little. When the thalluses are treated with alcohol, the mollusks accept them readily; and there are some, like *Plagiochila*, that they will even eat fresh, in spite of their disagreeable smell, because of the much sugar that is in them. But most plants of the order are avoided, because of the unpleasant taste and smell given them by their

* M. Stahl did not particularly concern himself with alkaloids, although they must have played a considerable part in defense in some of the plants that he experimented with. On this point we may refer to some of M. Erréra's conclusions, as given in the paper of himself and Maistrian and Clautrian (Brussels, 1887) on the "Localization and Importance of Alkaloids in Plants": "The alkaloids can hardly be regarded as other than the waste of protoplasmic activity. In fact, it has been proved by experiment that they can not serve as nitrogenous food to plants, and are toxic even to the plant that produces them. . . . The recent researches of Armand Gautier in the animal kingdom bring a strong confirmation to these views. It may be said that a few grammes of an alkaloid protect a plant against the devastations of animals as effectually as the strongest thorns."

fats. It is not always easy to determine of what other uses disagreeable or toxic chemical constituents may be to the plant; the point that concerns us in this discussion is, that they protect it from being eaten, and of this there can be hardly any doubt.

M. Stahl's study of the mechanical defenses of plants is no less interesting than that of their chemical armor. Many of the weapons of this character are obvious and well known; but some of them are more difficult of discovery, while a great variety prevails among them. In the large majority of cases the mechanical defense consists of a hardening of some parts of the plants, which may be general, so as to form a kind of carapace, or local, in the production of hard special organs, such as hairs, thorns, or needles, making it harder for animals to reach the plants. Sometimes the mechanical weapons are associated with chemical qualities, as in the nettle, crane's-bill, *Primula sinensis*, blessed thistle, etc. They either serve to prevent or impede the access of snails and slugs, to make it harder for them to take hold of the alimentary part, or to cause pain during the eating.

Hairy plants certainly offer more obstacles to snails going about on them than do glabrous plants. If we place a snail upon a comfrey-plant, it will find itself very uncomfortable, unable to get any hold on the leaves, and continually brought to a stop by the disagreeable contact of the hairs with its tentacles; and a free snail or slug will be hard to find on this plant. Other hairy plants possess immunity in less marked degrees; and M. Stahl's conclusions from his experiments as a whole are that chemical armor is more efficient than hairs. In some cases downy plants were preferred, while chemically armored species were always respected. So, when glabrous and downy species of the same family were tested, downy ones were eaten, while smooth ones were left alone. Hence, the hairs afford only an inefficient defense. M. Stahl accounts for this by supposing that, while the smooth plants are protected by disagreeable chemical constituents, the hairy plants are without this armor, or else present attractive qualities of odor or taste, against which their hairs are only an imperfect set-off.

Some plants are defended by the calcification of their superficial cells. The snails would not eat the leaves of *Erysimum cheirantoides* (treacle-mustard) when fresh, or even when treated with alcohol, but attacked them readily after the carbonate of lime had been dissolved out by acetic acid. The same was observed with other plants having a similar property. The grasses are protected against attacks from many animals by the silicification of the walls of their cells, without which the new enemies that would be added to supplement the assaults of their present foes would make an end of the whole family. This may be tested

by offering to snails full-grown leaves and young, tender ones of the same grass. The latter will be taken and the others left. But if, by a method of cultivation proposed by Sachs, we make a normally siliciferous plant grow where it can get no silica, it will be devoured at once.

Some plants, that were avoided after treatment with alcohol as well as before it, were found to contain a gum which the alcohol failed to remove, and which stood between the snails and the edible substance. Among these were linden, althea, cactuses, and gummy roots. Another series of plants, including an *Arum*, narcissus, leucojum, and the balsam touch-me-not, which contain no tannin or gum or substances of disagreeable taste or smell, appeared to be protected by raphides. Tabernæmontanus recognized in 1587 that the leaves of these plants produce a violent sensation of burning in the bronchial tubes, and that it is not due to soluble products or juices, but to the raphides, which are abundant in their tissues. This is proved by the fact that the filtered juice of the pounded leaves does not produce the burning sensation, while the residue on the walls of the filter, and the pounded leaves themselves, produce the characteristic sensation that is felt after chewing the fresh leaves. It is also confirmed by the fact that if the leaves of *Arum maculatum*, for example, are treated with dilute hydrochloric acid, which dissolves the raphides, animals will readily eat them, while they let alone leaves treated with alcohol, even when they have been steeped in sugar-water. In the case of the squill, snails avoid the outside of the scales, which are rich in raphides, and eat the inner sides, which are free from them. So in the narcissus and orchids, and various other plants, there are parts protected by raphides which are objectionable to snails, and other parts free from them that they eat. But, while raphides protect against some animals, they do not against all. Birds and ruminants do not object to the plants containing them; and even snails manifest different degrees of aversion to them. In a similar manner to these plants with raphides, some species of iris are protected by crystals of oxalic acid. It is very probable that the kinds of armor that we have named are available for protection against other animals than snails. But investigation on this subject has not been sufficiently advanced to permit of definite conclusions or generalizations.

Of the kinds of defense named, a minority of the plants studied by M. Stahl possess but one; many are endowed with two; and some with three—as, for instance, *Oxalis* (oxalic acid, tannin, and hairs); *Circæa* (bitter hairs, tannin, and raphides); *Smilax* (thorns, raphides, and poisons); *Aloe* (leaf-teeth, raphides, and bitter substance); and *Pontederia* (crystals of oxalate of lime, raphides, and tannin). In fact, considering the number of ene-

mies against which a plant has to contend to maintain its existence, their defenses are more numerous than we would suspect, and more important than we might at first believe.

In analyzing M. Stahl's results, we perceive that some families possess, as a whole, similar methods of protection: the grasses, sedges, and horse-tails, silicification; the rough-leaved orders, hairs; the *Amaryllideæ*, *Asparageæ*, orchids, and *Onagraceæ*, raphides; the gentians, bitter substance; the rose family, geraniums, legumes, and heaths, tannic acid; the nightshades, alkaloids; the labiates, ethereal oils; mosses, mechanical means (by silicification); and liverworts, chemical means, and one genus of them, *Riccia*, mechanical means also.

Different genera in the same family sometimes present quite diverse means. Among the lilies are genera (*Scilla* and *Ornithogallus*) having raphides; others, alliaceous compounds; lilies, tulips, and crown imperial, poisons. There are also differences between the species of the same genus; thus, one species of *Sedum* is protected by tannin, and another by an alkaloid. And in the same plant there are often very notable differences between the leaves, fruit, and root.

M. Stahl asserts that he has not found a single phanerogamous species, living in a wild condition, that is not armed in some way against slugs and snails. Such armor is wanting only among cultivated plants, or, rather, among some of them. It appears as if at the moment when man cultivates a species of plant, or takes it under his protection, using all possible means to facilitate its existence and remove its enemies, the plant gives up its own means of maintaining the struggle, surrendering its defensive armor at man's invitation. The common lettuce is a striking example of this fact. It is a favorite viand, as all know, of the *Gasteropods* of the garden. Nothing protects it against their attacks, and its smooth, tender, and succulent leaves make it a ready prey to them; yet it is the descendant, modified by cultivation, of the *Lactuca scariola*, which has chemical constituents so distasteful to snails, and so constant, that they will not eat it even after it has been treated with alcohol.

The defensive armor of plants is most frequently situated upon their surface, or where the attack begins. This is particularly the case with the mechanical weapons and such chemical ones as tannin, special juices, etc.

When we consider how varied are these armors of plants and how generally spread they are among all the orders, and that without them some species would not be able to exist, it is hard to deny that there is some special adaptation in them, or to suppose that they are merely accidental. The case is undoubtedly one of natural selection; and the fact that the protection is gained

sometimes in one way and sometimes in another, is not unfavorable to this hypothesis. It is with plants as with animals. One animal endures by means of his agility, another by his thick skin; another by this kind of defense, and another by that. The field opened by M. Stahl is one that has as yet been but little explored. It promises much that is novel, and bids fair to afford a new and most interesting chapter in the history of natural selection.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

BLOOD-VENGEANCE AND PARDON IN ALBANIA.

By HERR J. OKIE.

THE Albanians are accustomed to train ganders for fighting, for which purpose they feed them with such herbs as contribute most to the development of a pugnacious disposition. When one among them thinks his goose's courage has been sufficiently developed, he sends out a herald to go through the village uttering a challenge for any townsman having a gander which he is ready to pit in a combat to bring him to the ring for a match.

Such a challenge was sounded in the village of Unter Rogiza in the later days of August of last year. It was answered by a wealthy Albanian, who at once betook himself with his goose to the place where such spectacles were exhibited. His antagonist was already in waiting, with about a hundred on-lookers. The match had gone on for about two hours, when one of the champions began to fail. His owner wanted to help him, but the proprietor of the conquering goose would not permit it. Irritated by this, the losing owner raised his gun and shot the other man down on the spot. The spectators of the tragedy were so astonished for the moment that no movement was made to arrest the murderer, and he fled to the mountain. The friends of the murdered man instituted a pursuit of him, which was kept up for several hours, the murderer running up and down the hills, and his pursuers following him closely. Finally, when he saw that he could not escape, he turned toward the village and took refuge in the house of his victim. The dead Arso was lying in the room, and his mother beside him was weeping and lamenting the death of her only son. The murderer set his gun in the corner and said: "I am in your house; give me *bessá* (oath of protection), for they are going to kill me." He continued repeating these words till the old mother gave him the *bessá*. When his pursuers came up to the house, the mother of the dead Arso stepped to the door and waved a handkerchief toward them as a sign that no one should

enter. The pursuers scattered, only the father of the deceased remaining in the yard. When they had all gone away, he went into the room where the murderer of his son was sitting by the mother, with a part of her mantle thrown over his knee.

"Go out of the room," she called to him; "I have given him my oath!"

The old man, without speaking, set his gun in the corner, kissed his son's cold forehead, and went out to make preparations for the funeral. At sunset, while the people of the village were busied with the affairs of their inner households, and even Arso's relatives were engaged each in his own particular duties, the old lady took her charge by the hand and led him out upon the mountain. As soon as she had seen him at a safe distance she told him: "Now my oath is fulfilled; you must look out for yourself after this!"

The obligation of the *bessá* had terminated; now followed the pursuit of vengeance. The more industriously the family of the murdered man sought for retribution, the more earnestly the friends of the murderer exerted themselves to obtain pardon. This state of affairs continued through two months.

At last the whole circle of the murderer's relatives met and decided to ask the father of the murdered man to remit the blood-penalty to the murderer. For this they all rose—the women taking their infants from the cradle and carrying them along—and went in a body to Arso's father. In front of the company marched the murderer, his head veiled with a linen cloth, and the gun with which he had committed the murder hanging from his neck, muzzle down. Behind him walked two of his particular friends, and after them the rest of the family procession. As they came near the house of the avenger, they all cried out as with one voice, "*Aman! aman!*" (pardon); and continued the petition till noon. The father of the murdered man, without seeming to notice them, consulted with the members of his family whether he should, according to the customary law of the country, shoot the murderer at once or give him pardon. It was decided to pardon him. The father advanced toward the expectant company. The murderer knelt, ready to accept life or death, while the rest of the procession renewed their petition for pardon. The old gentleman took the murderer's gun and discharged it into the air; then lifted the cloth from his head and kissed him, in token of pardon. Then he kissed the other male members of the family procession, took the murderer by the hand, led him into the house, and set him in the son's place. The affair was concluded by a three days' feast in the avenger's house.—*Translated for the Popular Science Monthly from Das Ausland.*

MR. MALLOCK ON OPTIMISM.

By W. D. LE SUEUR.

AS, in olden time, a certain Lars Porsena, of Clusium, swore by the great gods that his friends the Tarquins, who had been expelled from Rome for gross misconduct, "should suffer wrong no more," so, in our own day, Mr. Mallock, of "Is Life worth Living?" seems to have sworn a great oath that the beliefs which the republic of modern thought has for good cause expelled from its borders shall by his powerful arm be restored to their old tyranny over human life. He therefore brings up his forces, draws lines of circumvallation, and prepares to conquer and capture the whole host of liberal thinkers, and either put them logically to the edge of the sword or force them back into the ancient slavery. The enterprise is not lacking in audacity, and, to do Mr. Mallock justice, he seems to be a writer of no little courage and of infinite jest. His sword-practice is always brilliant; and, if he could only induce his opponents to stand exactly where he makes his passes and slashes, there is no question that he would do for them completely enough. As it is, we see the gleam of the weapon; but, somehow or other, the foe does not fall, and we begin to perceive that he was never quite in the line of the strokes.

In furtherance of the purpose above indicated, Mr. Mallock has contributed two apparently powerful articles to the "Fortnightly Review"—one on "The Scientific Bases of Optimism," and the other on "Cowardly Agnosticism." We shall briefly examine the first of these to-day, and, perhaps, with the editor's kind permission, may take up the second at a later date. "Optimism," in Mr. Mallock's view, is the essential creed of all the modern schools of thought, whether Unitarians or Deists, followers of Spencer, followers of Matthew Arnold, or followers of Auguste Comte. All of these, whatever some of them may say to the contrary, really unite in worshiping Humanity; and Mr. Mallock undertakes to show them how foolish their worship is, and how mutually contradictory are the ideas on which it is founded. Let us take a brief but careful survey of Mr. Mallock's argument.

"The religious doctrine of Humanity," says this agile writer, asserts that the facts of history have a meaning, that they follow a certain rational order, and that, taken as a whole, they have been, are, and will be always, working together—though it may be very slowly—to improve the kind of happiness possible for the human being, and to increase the numbers by whom such happiness will be enjoyed. To affirm this, however, is, by implication, to affirm that a natural element in human character is

sympathy, and that not only is this feeling far stronger and wider than has usually been supposed, but it is capable even now, when once the idea of progress has been apprehended, of inspiring the individual to work for the progress in which he shares, and is sure to acquire, as time goes on, a strength incalculably greater. It is because the religion of humanity takes (as he says) such a cheerful view of things in general that Mr. Mallock rechristens it "the creed of Optimism." All the holders of that creed believe, we are told, "that the human lot has something in it which makes it, in the eyes of all who can see clearly, a thing to be acquiesced in, not merely with resignation but devoutness." This is the idea which Mr. Mallock undertakes to dispel by showing (1) that the doctrine of a steady progress in human affairs is not proved; (2) that sympathy is not the powerful emotion that optimists take it to be; (3) that admitting progress to be a reality, and sympathy to be all that it is claimed to be, the thought of the miseries humanity had endured in the past would poison all the satisfaction resulting from its improved condition in the present and its brilliant prospects for the future; (4) that the more we dwell upon the practical perpetuity of the human race the more is individual influence dwarfed in comparison; (5) that it is difficult to imagine what form or character the happiness we anticipate for our posterity can take, seeing that the absence of pain is merely negative in its character, and that the idea of an abundance of creature comforts is not one that can give pleasure to any human being capable of any high conception of life; finally, (6) that if we are to see any meaning in life we must follow a light which is not that of science—the light of theological faith.

Such is the argument of our opponent, supported throughout, it must be admitted, by more or less aptly chosen instances and an abundance of plausible rhetoric. The question is, How does it affect, how does it touch, any vital issue of the present time? Is it true that there exists in the world to-day a "creed of optimism" held in common by a number of otherwise divergent schools of thought, and that the elements of that creed are as described by Mr. Mallock? To this question we venture to give a negative answer. It is quite possible that individuals here and there may have constructed for themselves some such metaphysical creed as the above; but to say that any large number of representative thinkers of our time could be got to take their stand on the propositions formulated and criticised by Mr. Mallock is to state what we are confident is not the case.

The situation to-day is simply this: A theological creed which had descended to our age from very early times has been found, when examined from the historical point of view, to be as little proof against criticism as the moral, political, and scientific ideas

of the same period. The considerations which moved our ancestors to belief do not and can not move us; and, therefore, so far as the theology in question furnished an interpretation of the world or a guide to conduct, men who can not now accept it are compelled to look around for other canons, other sanctions, other modes of arriving at truth. The thinkers of this age have not deliberately made this situation for themselves. The change has come, upon the whole, very gradually; and human beings are every day being born into an atmosphere in which the ideas that were current in the earlier centuries simply can not live unless in some manner artificially protected. The difference between our time and the former age consists mainly in this, that educated men have now something like an adequate idea of what knowledge is, and of what proof is, and that they have got into the way of asking for proof before they yield belief. That this was not formerly the case—that men believed for the most fantastic and ridiculous reasons—could be abundantly proved if necessary; but surely it is not necessary. The task, then, which is assigned by dogmatic theology to this generation is to believe without those aids to belief which the more habitual supernaturalism of our more ignorant ancestors supplied. Some try to do it and succeed, making ends meet by ways and means best known to themselves. Some try and do not succeed; and some feel dispensed from trying at all. Monotheism it must be remembered was not a special revelation to mankind. There are good grounds for the belief that, in every case it has resulted from the consolidation of an antecedent polytheism; while polytheism itself has been a delusion forced upon men's minds by the countless activities in nature which they have been powerless to explain to themselves in any other way. The time has come at length when, as an explanation of nature, monotheism itself has lost its virtue; not because there are not many dark problems still to be solved, but because monotheism is recognized as rather the assumption of a solution than a solution. Men, even those who view things in this light, may still be theists, but intelligent men at least are not theists merely because they can not understand everything in nature. Their reasons are of a different order.

Instead, therefore, of there being anything in the condition of men's minds to-day or in the average philosophy of the time to provoke ridicule or hostile comment, there is much that calls for every allowance and consideration. The science, the history, the philosophy, the political and social organization of the past are discredited. Its theology is discredited, too, and men are engaged in a strenuous effort to lay new foundations and rear worthier superstructures in every department of thought. The workers, happily for themselves and for the world, are not all brigaded and dra-

gooned by the voice of authority, and therefore they are not all working on the same lines; but they are *working*, and their sincere labors will not be in vain.

The question, however, at present is whether the various liberal schools referred to by Mr. Mallock stand committed to the new dogmatic system which he has described. The first thing that strikes a careful reader of his article is that he has not given a single quotation from any leader of modern thought indicating acceptance of the views in question—a thing which it would certainly have been easy to do if these views were, as he maintains, fundamental with them all. It is an illusion into which a man easily falls, whose own thought has run in dogmatic lines, to suppose that others must have constructed for themselves a philosophical or logical framework of equal rigidity. The truth can not, therefore, be too often repeated that the essential mark of modern thought is the taking of the world just as it is, and the reduction of all theories more or less to the rank of working hypotheses. Whether the changes in human affairs support the theory of a great secular drift toward better conditions is a question to be decided simply according to the evidence, which can hardly under any circumstances be of a demonstrative character in the full sense. The simple fact that men have the power of rationally adapting means to ends is enough to prompt to effort and inspire hope, for in this power lies the key to the highest possibilities of advancement. He who knows can, and, as long as this is the case, the path of knowledge will be the upward path. Knowledge, to be sure, is sometimes abused. Why? For want of more knowledge. There may come periods in the history of a people when the virtue of such knowledge as they possess has become exhausted, and when in the rude school of experience they may have to learn other practical lessons as the necessary condition of further advance; but how all this may be is a matter for which no individual man is responsible, and one who should wait to devise a practical philosophy for himself until he had cast the horoscope of humanity would not be wise. The late Mr. Arnold thought he had discovered clear traces of "a power, not ourselves, that makes for righteousness"; but he did not wait for the formulation of that discovery, if such it was, before striving to order his own life on principles of righteousness. And if some one comes forward and points out, as one critic at least of Mr. Arnold did, that whether "the power" is making for righteousness or not depends upon the stage of a nation's development, there being periods when the general forces make rather for unrighteousness, no one is obliged, even though he may regard the criticism as pertinent and well-founded, to abandon his previously adopted plan of life.

If, therefore, Mr. Mallock would really make the position of an independent, non-theological thinker of the present day untenable, he must show, not that the theory of progress in general is without logical support, but that, taking the world as it is known to us, there is no support outside of theology for intellectual or moral effort. Let Mr. Mallock show that, because we can not share his views in regard to the government of the world, we can not desire the good of our neighbor or draw the distinction which the poet draws between "a higher and a lower," and we shall at once acknowledge our situation to be a very serious one. It is simply because he can not show anything of the kind that he adopts his present tactics, which are to saddle on the liberal schools doctrines which they do not hold, and then to attack those doctrines with his heaviest logical ordnance. In regard to the doctrine of progress, Mr. Spencer is perhaps the most authorized exponent of modern ideas, and how far he is from maintaining it in anything like an absolute form may be gathered from his works at large and very conclusively from the eighth chapter of the first volume of his "Principles of Sociology." A quotation or two may be permitted: "If, on the one hand, the notion that savagery is caused by lapse from civilization is irreconcilable with the evidence, there is, on the other hand, inadequate warrant for the notion that the lowest savagery has always been as low as it is now. It is quite possible, and, I believe, highly probable, that retrogression has been as frequent as progression. . . . Of all existing species of animals, if we include parasites, the greater number have retrograded from a structure to which their remote ancestors had once advanced. . . . So with super-organic evolution. Though, taking the entire assemblage of societies, evolution may be held to be inevitable as an ultimate effect of the co-operating factors, intrinsic and extrinsic, acting on them all through indefinite periods of time; yet it can not be held inevitable in each particular society or even probable. . . . Direct evidence forces this conclusion on us. Lapse from higher civilization to lower civilization, made familiar during school days, is further exemplified as our knowledge widens."

Any candid person can judge from these passages how far Mr. Spencer must be from basing any theory of human conduct upon the abstract notion of the progress of the human race. His moral system, as is well known, has nothing to do either with a general theory of progress or with the sympathetic interest which individual men may take now or hereafter in the fortunes of humanity at large. If we turn to another writer of very "advanced" opinions, but whose standpoint differs materially from Mr. Spencer's —Dr. Maudsley—we find that he too lays no great stress upon the idea of progress, and very fully recognizes the many evidences

of retrogression which history and natural history alike present. "It admits of no doubt," he says in one place, "that a law of degeneration is manifest in human events; that each individual, each family, each nation, may take an upward course of evolution or a downward course of degeneracy. Noteworthy" (he adds) "is the fact that, when the organism—individual, social, or national—has reached a certain state of complex evolution, it inevitably breeds changes in itself which disintegrate and in the end destroy it."* Turn now to Mr. Leslie Stephen, a writer as free from all theological prepossessions as either Mr. Spencer or Dr. Maudsley. Far from making the assumptions which Mr. Mallock attributes to the whole liberal school, he criticises some of those assumptions in terms that resemble very closely those used by Mr. Mallock himself. For example, he tells us that, while speculations in regard to a future Utopia for human society "may be useful in defining an end toward which all well-wishers to their fellows may desire to act," such speculations are nevertheless rash, and do not solve the difficulty for us, inasmuch as "the knowledge—if we could attain the knowledge—that our descendants would be better off than ourselves would not disprove the existence of the present evil." Pushing the objection further, he says: "We can not tell that progress will be indefinite. It seems rather that science points to a time at which all life upon the planet must become extinct, and the social organism may, according to the familiar analogy, have its natural old age and death."†

There is no use in taking up space with further citations. The fact is, we would not, at this moment, know to what writer of the several schools of thought referred to by Mr. Mallock we could turn, to find that dogmatic assumption of progress which he says is characteristic of them all. What characterizes them all is a manly determination not to despair of the fortunes of humanity because the former monopolizers of spiritual authority have suffered an abatement of their prerogatives and now expend a large portion of their energy in anathematizing the tendencies of the age. What further characterizes them all is a conviction that morality and happiness must have sources independent of human institutions and abstract philosophies, and that, certainly, neither demonstrable falsehoods nor unverified theories of any kind can be their absolutely necessary conditions. Mr. Leslie Stephen expresses this well when he says: "It may be said that the whole history of the world and its inhabitants represents a problem of stupendous magnitude. . . . We work out the problem by living, or rather we work out our own little bit of the problem. We are utterly incompetent to grasp the whole or to rise above it, and say why such and such data must have been

* "Body and Will," p. 238. † "Science of Ethics," p. 444.

given, and what will be the further stages of the process. But when we once recognize the fact that the problem is being worked out, we see that an answer is actually given in some degree by the very facts before us. That is really the nature of the change in the point of view implied in the acceptance of the evolution theory." *

Having thus shown to how large an extent Mr. Mallock has drawn upon his imagination in regard to the importance assigned in modern ethical theories to the idea of progress, it is easy to show that what he has said on the subject of sympathy is equally destitute of foundation. The emancipated modern thinker tries to take stock of human nature as it is: the age for constructing ideals of a purely imaginative kind has passed. We want to ascertain just how much sympathy there is in average human nature, so that we may know what we have to depend on. We want to discover also how far the quantity now existing admits of increase. Auguste Comte studied this question closely; and, far from unduly magnifying the sympathetic element in human nature, he continually speaks of it as being very weak in comparison with the egoistic, and therefore requiring all the re-enforcement we can give it. His whole system is an elaborate effort to draw out sympathy and make it more widely and powerfully operative in human affairs. For this purpose his followers think it right and profitable to dwell much upon the history of the human race, and to bring into strong relief the organic dependence of the individual upon society at large. Many who, perhaps, would not care to acknowledge any obligations to Comte, are to-day doing the same thing—so much so that the prominence given to the thought of society as an organic whole, infusing its own larger life into its individual members, may be said to be an especial note of the present age. If it be asked what object there can be in quickening sympathy between a man and his fellows, the answer is, the promotion of more harmonious social action, resulting in economy of force and increase of happiness. Upon this point Mr Mallock seems to be all astray, owing doubtless to the too abstract manner in which he chose to treat the question. He seems to think that the whole effect of sympathy is confined to the mental representation of others' pains and pleasures. He forgets, apparently, that it has its natural outcome in action; and that, except as a basis for action, there would be no useful purpose in cultivating it. This is the true and obvious answer to his paradoxical contention that an increase of sympathy could not make for happiness, seeing that if, on the one hand, it enabled us to enter more heartily into the joys of others, it would, on the other, bring home to us more poignantly their sorrows. We can

* "Science of Ethics," p. 34.

not increase sympathy with mankind at large without strengthening the sense of duty and prompting to deeds which—whether they take the form of promoting happiness or averting misery—will themselves be a source of blessedness to the doers. What is wanted is simply such a development of sympathy as will best subserve the interests of society; and Mr. Mallock's idea that a power of sympathy sufficient to prompt men to lead virtuous lives would also be sufficient to fill them with anguish at the thought of all the past sufferings of mankind, is altogether fanciful and hollow.

An assumption which vitiates much of Mr Mallock's reasoning on this whole subject is that right conduct is, in the human sphere, a kind of rare and frail exotic, requiring the services of a theological gardener and the warm, heavy-laden atmosphere of some ecclesiastical hot-house in order to live at all. But that is a view which we are under no obligation to accept, and which the facts of life are very far from suggesting. Why should the relations of man with man be, in their own nature, everlastingly wrong? Surely there is sunlight enough, and air enough, and earth enough, and water enough, for a good many of us to live together on this earth in peace and concord and mutual helpfulness! Surely men have need of one another, and it is difficult to imagine how they could long work together without the development in their minds of the conception of justice. In point of fact, the idea of justice is in the world and has been in it in one form or another for many ages. The task that is set before us to-day, with our widened experience and deepened reflection, is to realize that idea more and more perfectly in all social relations. Why should we wish to do it? Because we know that justice is good, and because our sympathies, aided by a certain diffused feeling of self-interest, prompt us to strive for the perfecting of society. But, apart from all voluntary or deliberate effort, the idea of justice acts as a powerful leaven in the society into which it enters, and we may hope that by and by it will leaven the whole lump. When Mr. Mallock says that "the problem is to construct a life of superlative happiness," he makes a complete misstatement so far as any problem contemplated by the thinkers he criticises is concerned. Theologians promise a life of superlative happiness in another world, but non-theological reformers are more moderate in their expectations. What the fortunes of the human race may be in the far-distant future they do not undertake to predict. They may sometimes, like the poet, dream their dream of good; but, if so, it is a good such as the conditions of human nature and its environment are capable of supplying. It is hard to understand how Mr. Mallock could bring himself to make such a statement as that just quoted. Admitting that theo-

logians attack the problem of "constructing a life of perfect happiness," does it follow that the liberal thinkers of the present day must follow them on that ground, like the magicians of Pharaoh, imitating, to the best of their considerable ability, the miracles of Moses and Aaron? It would be much to Mr. Mallock's benefit if he could only be persuaded, once for all, that the distinguishing mark of the whole evolutionary school is that they take the world as they find it, and expect no more from it than it is adapted to render. If human history as a whole is predestined to be a failure, that is none of their affair; they are not in the business of insuring worlds or universes or even civilizations. All they can say—and this they do on the ground of experience—is that, taking the world and the human consciousness as they are, there seems to be one line of conduct which best subserves human interests; and which, therefore, they will both follow themselves and recommend to others. That line consists in practicing the lessons that Nature and history have taught us, using our faculties for the acquisition of real knowledge and our powers of foresight for a wise adjustment of present action to future needs and results. If the man who is filthy spurns this humble, unpretentious philosophy, and determines to be filthy still, he must be allowed to exercise his preference, as he has done under other dispensations. Wisdom will still be justified of her children, though the gospel of science should be hid to them that are lost.

Mr. Mallock is much concerned over what the future of humanity will be if his principles do not prevail. He can not "feel any pleasure in the thought of a Humanity 'shut up in infinite content,' when once it had secured itself three meals a day, and smiling every morning a satisfied smile at the universe, its huge lips shining with fried eggs and bacon." Well, if the time should ever come when humanity has nothing to be satisfied with save abundance of food and a good digestion, Mr. Mallock's delicately chosen image may be in some measure realized; but why it should be necessary to imagine such a future for society, merely because knowledge is growing and superstition waning, it is not easy to say. Why should not "knowledge grow from more to more," and yet "more of reverence in us dwell," so that—

> ". . . mind and heart, according well,
> May make one music as before,
> But vaster"?

It is hard to conceive any reason except such as might be supplied by the petulance of a disappointed partisan. Mr. Mallock would fain persuade us that, save on his principles, life is not worth living; but, despite his elaborate argumentation, the modern world, while departing ever more widely from his favorite

principles, goes on living and enjoying life. Hence these tears, and these savage diatribes against an imaginary dogmatic optimism on the part of his opponents. To him they perhaps seem optimists, as not sharing his pessimism; to their own apprehension they are simply children of their age, listening to its teachings with earnest attention and trying to utter the message they receive.

What, after all, would Mr. Mallock have us do? He says that there is no evidence of any meaning or of any general progressive movement in human history—none that "would be accepted either in physical or philosophical science." Yet he wants us to believe on some *a priori* ground, which he is prepared to present, that life *has* a meaning and *does* exhibit progress. If we will only accept the light that he offers, we shall see that "life is full of august meanings"; but that light, he plainly tells us, is not the light of science. In the same way he offers to invest with infinite significance and value any little services we may render to humanity—services which, considered simply as offered by man to man, would not be worth taking into any kind of account. The method in this case is to bring our offering to Christ, who "judges it by the effort and the intention." The altar of humanity, then, is not a sanctifying altar; and men must be assured of a high rating for their sacrifices before they will be content to make them. "The love of humanity without faith to enlighten it, and nothing to justify it beyond what science can show, is as absurd as the love of Titania for Bottom." The reply to this is that long before what Mr. Mallock speaks of as "faith" was known in the world the nobler spirits among men had a love for humanity, and were further ennobled, not made ridiculous, by their love. From the commencement of history, indeed, down to the present day, there has been but one way of being noble, and that has been by caring for one's fellow-men. That way some have found out in an eminent degree, and multitudes in a lesser degree, without any aid from theological fancies. In the present day, when the laws of social development and the true relations of individual life are so much better understood than formerly, there ought to be, and there is, much more to nourish in individuals a rational regard for the general welfare. The love of Titania, whether for Bottom or for Oberon, supplies no apt illustration here, since the case is not one calling for romantic love, but simply for loyal devotion to a recognized source of good—to that higher life of society without which the individual life would wither and starve.

Mr. Mallock's terms are too hard. Much as we might wish to read those "august meanings," much as we might wish to feel that our gifts to humanity received instant recognition and sympathetic appraisement, if it is a question of reinstating the Tar-

quins of ecclesiasticism, we must forego those visions; we must look within for our reward. Better to face a sterile universe than submit to a spiritual tyranny. But to us the universe is not sterile, nor is life without meanings which might almost be pronounced "august." The theological solution of the problem is simply an adjournment: the next world is to clear up the mysteries of this. The scientific solution may be summed up in the word "adaptation." There is a law in things which slowly reveals itself to careful observation; and just as that law is read, learned, marked, and obeyed, does human life grow in value and more and more carry its own justification within itself. "It doth not yet appear what we shall be" is a saying very applicable to the future of our race upon the earth. Supposing it possible that religion should in the future take the form of an earnest study of the laws of life and of morality, personal and social, who can forecast the glory that might yet be revealed in this despised humanity of ours? And who would not feel, in presence of such a transfiguration, that it was "good for us to be here"? If anything will thus transfigure society, we venture to affirm that it will be science pursued in a religious spirit—that is, regarded as a ministry of truth and good to mankind. There is a force available here that is at present little understood. It may possibly never be understood by more than a few: no one can answer for that; but it is impossible not to hope that some day, for a religion based on relics and texts, on myths and traditions, on dogma and ritual, on barren erudition at one end of the scale, boisterous sentiment at the other, and infinite mystification throughout, may be substituted one founded on the truth of nature and directed with undivided aim to the perfecting of humanity. Already we see, here and there, how much of pure happiness the right adjustment of human relations can create; and we do not see why the law, by virtue of which such happiness is produced, should not become more widely known and more faithfully observed. It is the habit of the self-styled orthodox to fling all the failures of the universe at our heads, as if we had produced them, or were at least specially responsible for explaining them. The habit is an idle one: the responsibility is not ours; but now that the light of scientific—that is, of verifiable—truth has come into the world, we do hold ourselves responsible for bearing witness to it, and causing it to shine as widely as possible. And, as we are not answerable for the past, neither do we assume to control or predict the future. We see merely a duty in the present, a duty the performance of which will bring peace, tranquillity, and security. This is not optimism, but it is in every man's power to make it a religion.

SAVAGE LIFE IN SOUTH AMERICA.

By Captain JOHN PAGE,
OF THE ARGENTINE NAVY.

THE Gran Chaco derives its name, according to Charlevoix, from those great Indian battues, or collections of wild game, which, surrounded by a cordon of fire and hunters, were gradually driven to a given center. It is a vast central tract of country lying between the southern tropic and 29° south latitude, bounded on the north by Brazil and Bolivia, on the south by the Argentine province of Santa Fé, on the east by the Paraná and Paraguay Rivers, and on the west by Santiago del Estero and Salta. It contains about one hundred and eighty thousand square miles, or considerably more than the superficies of Great Britain and Ireland. About one third part of this vast area belongs to Paraguay, but the exact demarkation of the limits between the Argentine Republic, Bolivia, and Paraguay has still to be made, although between the first and last of these countries an arrangement was entered into through the arbitration of President Hayes, of the United States, which must necessarily be called satisfactory. The Gran Chaco has been called, particularly in allusion to the low-lying Paraguay section, the "*Oceano firme*," or solid ocean. In fact, owing to the comparatively limited means of communication, it was formerly considered too vast for an undivided control, and the Argentine part was constituted into two territorial governorships—one called the Chaco Austral and the other the Chaco Central. A third section is that belonging to Paraguay, part of which, along its northern side, is disputed by Bolivia, and goes by the name of Province of Azero. The Chaco Austral is the most favored in natural riches of these three great sections, and has extensive primeval forests.*

The principal water-courses of these territories are the Pilcomayo and Bermejo, which are undoubtedly destined to become highways of commerce. The waters of these rivers differ in color, those of the Pilcomayo being dark and sometimes brownish, and those of the Bermejo red, as its name indicates; both are narrow

* Mr. Clements Markham said, in the discussion on Captain Page's paper, that the Gran Chaco was a most important region, lying between the plateaus of the Andes on one side, and the great fluvial highway of riches. In the Quichua language "chacu" meant a hunt, but under the government of the Incas of Peru the word was used for that festival when they surrounded and numbered their flocks. It was a counting of wealth. Hence the *Hatun chacu*, or *Gran chacu*, was so named by the Incas, because those vast, forest-covered regions to the east of their mountain homes were a source of wealth to them in wild animals, precious drugs, and the highly prized harvests of coca. In the distant future the channels which flowed from the homes of the Incas across the Gran Chaco were destined to bring down the produce of the Andes to markets beyond the Atlantic, but that time had not yet arrived, although the speaker believed it was near at hand.—Editor.

and tortuous, and both run in a general southeast direction, preserving a remarkable parallelism throughout their course, at a distance of about one hundred and eighty miles. Their depths and general characteristics correspond, and they are frequently obstructed by narrow argillaceous beds and fallen trees. The waters of both rivers are drinkable, but hard and unsuited for washing. The Bermejo brings down an enormous amount of sediment, which is deposited with such extraordinary rapidity that it must be considered a peculiarly strong feature of the mechanical work of the river, by which its geological formations are made and unmade. This swift precipitation of its detritus, which it replaces by an increasing abrasion of the banks, goes on in the Bermejo, even when at its height and when in the exercise of its greatest carrying-power, with a speed equal to the square of its normal current. I have seen this river eat away an entire point of land, and by way of compensation deposit, just a turning below, an amount of detritus sufficient to form a similar promontory, which in one season of low water became covered with a thick and luxuriant growth of red willow. The Pilcomayo is to a great extent unknown, and in one section that is quite unknown is invested with a mythical halo in the shape of a tradition that it disappears. An apparent disappearance is a phenomenon which seems to have taken place with some rivers. The upper Paraguay, as I have witnessed, has been known to flow, as if absolutely lost for many miles, beneath a matted covering of living and dead vegetation several feet in depth. In the year 1858 one of these growths, under the influence of an extraordinary inundation, broke loose and drifted two thousand miles, down to Buenos Ayres, where it brought up, with many wild animals and reptiles that had taken refuge there from the almost universal deluge. The Pilcomayo is not affected in this way, and I believe that it not only does not become lost, but that there are no insuperable obstacles to its navigation. At the point where it is supposed to be lost, it begins a very erratic wandering—after running a few miles to the southeast, it suddenly turns to the north, leaving several minor branches looking in the opposite direction. It then returns as rapidly to its general southeast course, and, while subject to overflows, the main body of it flows on in a natural bed uninterruptedly to its mouth.*

* Colonel Church remarked, in the discussion, that the Argentine Republic seemed to be divided into two sections—that of the Pampas, without forest, and that of the Chaco, which was a forest-covered country. Curiously enough, the rains of the Chaco district did not occur during the rainy periods of the Pampas district; but from November to May there was a veritable downpour, and the country became flooded, filled with lagoons, with here and there an island or small hill. At the head-waters of the Bermejo there was on such occasions a lagoon forty leagues across. It was a very difficult problem to him how the Pilcomayo and the Bermejo could ever be usefully navigated. The former, one hundred and eighty leagues above its mouth, filtered itself through a sandy swamp one hundred

Several attempts have been made to explore this river. The story of one that was undertaken under the Bolivian Government has been told with such exaggerations as almost mark it a work of fiction, by Lieutenant Van Nivel. A tragic interest attaches to the expedition of Dr. Crévaux, of the French Geographical Society, who undertook to work along the banks of the river. The party were enticed inland by the savages and murdered. A later Bolivian expedition of one hundred troops, accompanied by a French traveler, M. Thouar, were harassed but not actually attacked by the savages, and, after wandering considerably out of their course, succeeded in reaching the Paraguay, having traversed the Chaco in a southeast direction more or less along the river, but without in any manner elucidating its geography.*

miles in diameter, while above this swamp it was filled with falls, rapids, sand-banks, and snags. The bed of the latter oscillated backward and forward to the extent of thirty or forty miles, carrying with it great trunks of trees of very hard wood, the specific gravity of which exceeded that of water. The rainy season was succeeded by one so dry that animal life almost perished for lack of water. There was a distance of twelve hundred and fifty miles along the Bermejo to its mouth in which it received but one branch.—EDITOR.

* Dr. Crévaux, already distinguished for his work in exploring the boundary of Guiana and Brazil, was commissioned to endeavor to reach the opposite side of the Amazon Valley by way of the upper Paraguay. At Buenos Ayres the members of the local Geographical Society interested him in the idea of tracing the course of the Pilcomayo. So, instead of ascending the Paraguay, he went by railway to Tucuman, crossed the Bolivian border on the 16th of January, 1882, and made his way to Father Doroteo's mission, San Francisco, on the Pilcomayo. At about the same time a military expedition sent against the Toba Indians of the Chaco to punish them for some depredations had returned, bringing seven children as prisoners. It was deemed best to send a messenger to them—a Toba woman named Galla or Petrona, who had lived for some time at the mission—to learn how they would receive the explorers. The messenger did not return, but, as was afterward learned, instigated the Indians to murder Dr. Crévaux and his companions. The party, numbering twenty persons, without waiting longer, started on the 19th of April. On the 27th of the same month they were all massacred but one.

M. Thouar started from Santiago in May, 1883, on hearing that the Tobas held as prisoners two survivors of the Crévaux expedition. Following Crévaux's steps from Tarija and the advanced post of Caiza, he reached the scene of the massacre and founded there toward the end of August the colony Crévaux. He learned, from a number of the aborigines whom he interrogated, that none of the Crévaux expedition survived; but, not satisfied with what the Indians affirmed, he plunged into the unknown region and undertook with fifty Bolivian soldiers to descend the Pilcomayo in the midst of the hostile tribes. His party, which was weakened from time to time by desertions, descended the right or Argentine bank of the river, plunged through deep, brackish marshes, narrowly escaped a surprise by two thousand Indians, repelled an attack by eight hundred of them, found further traveling through the swamps impracticable, and crossed over to the other side of the river; and, finally, in October, having reached the beginning of the great delta of the Pilcomayo, gave up the attempt to follow the river further, and took the shortest course for the Paraguay, which they reached after a month's journeying in great suffering. M. Thouar returned to the exploration in 1885, and, starting from the southern part of the delta, went up by land eighty leagues to the place where he had left the Pilcomayo on his former expedition, and thence descended the river in a canoe to its mouth. After this he was engaged by the Bolivian Government in two attempts to find a route for a wagon-road

The Bermejo River in 1869–'70 became deflected from its ancient course and actually wandered about for a long time before finding a new bed. It formed for the time being an island nearly two hundred miles in length by an average of fifteen miles in width. This change of bed in our times enables us to understand the mechanical work which this and the Pilcomayo rivers have carried on for many centuries, resulting in the production of the rich alluvial lowlands of the Gran Chaco. It is an interesting fact that the Bermejo in this as in other changes of less magnitude has manifested a tendency to swerve to the eastward sufficiently marked to suggest the idea of some physical cause.

The Bermejo, like the Pilcomayo, has been the object of many expeditions to open up its waters to navigation. Between 1853 and 1858 my father, Captain Page, under the auspices of the United States Government, explored the fluvial system of the Rio de la Plata, and, with the assistance of a staff of competent officers, made extensive collections in botany and natural history, which were deposited at the Smithsonian Institution. He made track surveys of all the rivers so far as he examined them, and established wherever he went those positions which are the standards to this day used in the cartography of those countries. In the course of these explorations he twice entered the Bermejo and once the Pilcomayo, ascending the former to a distance of nine hundred miles by river course, and turned back, paradoxical as it may seem, on account of the excess of water which had flooded the country, fearing that his steamer, in case of a sudden fall, the course of the river being unrecognizable, would be left stranded in the interior. This was the only expedition up the Bermejo undertaken with purely scientific views. Its results are embodied in the book, "The La Plata, Argentine Confederation, and Paraguay."

The author was commissioned in 1885 to examine the Bermejo and report upon its navigability. He started on the 25th of June. The way for the first three hundred miles from the mouth of the river was interrupted by obstructions caused by the wrecked vessels of former exploring expeditions; the falls of Yzo, a sharp incline of some two feet in the mile over about that extent, which causes the water to run swiftly and eddy around and look formidable to the uninitiated; and the argillaceous bars. The most formidable barrier of the last class was overcome by fixing a chain-drag with four pickaxes fastened uprightly in it, which was drawn forward and backward over the clay, marking a scratch

from Sucre, in Bolivia, to Puerto Pacheco on the Paraguay. Both projected routes proved impracticable from want of water, and M. Thouar is said to be satisfied that the only feasible route from Bolivia to the Paraguay lies by way of the Pilcomayo.—EDITOR, *from "La Nature."*

which the water in a few hours washed out into a navigable channel.

At about three hundred miles above the mouth of the Bermejo the author entered the Teuco, or the channel opened by the erratic waters of that river when they departed from their original bed. In many places along the old bed successive annual floods have covered with rich deposits the low-lying lands, leaving the tops of large trees peering above the surface. It would be impossible for the least sentimental not to admire and feel the influence of those rich woods, clothed in perpetual verdure, the trees entwined by the Paraguay jasmine, with its delicate white and blue flowers, whose fragrance is perceived as you run along the banks, and covered with other climbers, parasites, and orchids in great variety. There is a certain richness of growth in these wilds, filled with the native pineapple, which is unlike the rankness of the Brazilian tropical vegetation, so suggestive of jungle fevers. A Mr. Plaisant, in 1854, by direction of the Minister of Commerce of France, made an analysis of the woods of Paraguay, which practically may be said to be identical with those of the Chaco, and he concluded that they might be advantageously employed to take the place of those used in Europe for cabinet work. Many of them are certainly very beautiful; the *tatané* (*Porliera hygrometrica*) compares favorably with the bird's-eye maple; the *palo rosa*, the Guayacan *Cesalpinea melanocarpa*, a variety of *Lapachos*, the *urundey*, *curupáy*, and *cumpaynâ*, the *quebracho*, with a hundred others, all of hard, indestructible wood, when used in the earth or water, and which would hold their own with any of the woods of Europe or Asia. Mr. Plaisant classified thirty-nine species of superior quality, useful for naval construction and cabinet work, exclusive of a great number which had special applications for medical and domestic use. Most of the trees I have enumerated are actually used in Argentina in great quantities for ship-building, fencing, telegraph-lines, and railway sleepers. The three species of *algarroba* produce the long locust-pod, a staple article of food with the Chaco Indians, who pound it up and make it into a very sustaining bread. They also brew from it an intoxicating beverage, under the influence of which they become dangerous. The pod is very fattening food for cattle and horses, having a great percentage of saccharine matter. The presence of the *algarroba* is an indication of high land not subject to overflow. The *alba* species is employed extensively in the manufacture of hubs and furniture; its bark is good for tanning purposes, and a majority of the window and door frames of the older houses of Buenos Ayres are made of it. The "palo santo," holy wood, or lignum vitæ, is seen in quantities north of the twenty-sixth parallel. Its wood, which is extensively

used for blocks and bushings, is so full of resinous matter that it will burn like a candle.

Among the useful plants is the *caraguatá*, of the family of the *Bromeliaceæ*, which grows generally within the range of the forests, and from which the Indian obtains a strong fiber useful for many domestic purposes. It is said to be the fiber known to European manufacturers as Batista Ananá. The *caraguatá* has also a faculty of catching and retaining water, whereby the Indians are afforded means of slaking their thirst in seasons of drought. Among a hundred edible wild fruits may be named the *chañar;* the *vinal;* the *guayabo*, a fine fruit; the *ubagay*, a passion-flower, which gives a large but rather insipid fruit; and the *manduvira*, a wild almond. Several *Lacteas* produce a fine fruit, and the woods are full of the wild pineapple.

The exploitation of the timber industry has occupied several thousand people, and has been the means of reducing to a *quasi*-civilization many hundreds of the aborigines. This has led to the development of the Austral Chaco along the borders of the Paraná, where are now many small towns and large agricultural colonies, prosperous beyond their own hopes, and connected by rail and telegraph. Two of these colonies are owned by Englishmen; and the word of the proprietor of one of them is given that the Indians are of the best laborers, being the most docile and steady, although a trifle more indolent than the civilized workmen. As I continued my ascent of the Bermejo, with but little other interruption than was occasioned by the draught of my vessel, I always found large masses of Indians at the low passes, which are indeed their fishing-grounds; at these points, which were numerous in the upper Teuco, they would wait, evidently in expectation of some catastrophe or something giving them a chance to make an attack. They were usually on these occasions made up with their war-paint, and many of them decorated with ostrich-feathers, but they generally kept their arms out of sight, though doubtless handily within reach; and they would come to us with articles for barter, consisting of dried fish, necklaces, a few bows and arrows and war-clubs, the skins of wild animals, and the animals themselves. I was never attacked, though often threatened.

It is a safe prediction that this region has a great future, possessing as it does an equable climate, tempered by the prevailing southeast and southwest winds, with just enough of the warm and relaxing weather to give a zest to the enjoyment of the other kind and stimulate vegetable growth; a climate which throughout the whole extent of its territories suits admirably the sons of southern Italy, and in its southern section has been proved to suit the hardier men of England and the United States. The soil is

good, and compares well with the lands of southern and western Buenos Ayres, having in its favor, for agricultural purposes, a far better climate; and is adapted to the growth of cotton, tobacco, the castor-oil plant, the olive, barley, sorghum, Indian corn, rice, the manioc, and many other products of temperate and intertropical climates. Cattle thrive in all the Chacos, attaining an extraordinary development in size, especially among the Indian herds, where they depend exclusively upon the grasses and wild fruits such as the palm and locust. The grasses are varied and abundant, and include many of the species highly thought of in Buenos Ayres, which is the pre-eminent cattle-growing section just now of the Argentina.—*Abridged for the Popular Science Monthly from the Journal of the Royal Geographical Society.*

SKETCH OF LAVOISIER.

ANTOINE LAURENT LAVOISIER was born on the 26th * of August, 1743, and suffered death by the guillotine on the 8th of May, 1794. His family, descended from a postilion in the royal stables in the previous century, had gradually risen in estate. His father, styled in the standard biographies a "wealthy tradesman," is described by M. Grimaux, in the "Revue des Deux Mondes," as a graduate of the law school, and advocate and attorney in the Parliament of Paris. The family had also considerable wealth on the mother's side. Lavoisier's father was thus able to provide his son with good instruction, and interested himself in doing so. The youth was sent to the Collége Mazarin, where he was remarked as a brilliant pupil and a diligent student. Science at once became the prominent object of his studies. After leaving the college he took a course in law, and was admitted as an advocate in 1764. At the same time he began those studies by which he became eminent in many branches of science. He pursued mathematics and astronomy with the Abbé La Caille; botany with Bernard de Jussieu; mineralogy and geology with Guettard; and chemistry with Rouelle. At twenty years of age, while he seemed to give the principal share of his attention to mathematics, he became interested in meteorology, and began a series of barometric observations, which were continued through his whole life.

So interested did Lavoisier become in his studies that he was ready, in his twentieth year, to give up general society and confine

* So it is given in the "Biographie Générale" on the authority of J. Lalande, and by M. Edouard Grimaux, who writes on the authority of original manuscripts and correspondence in the "Revue des Deux Mondes" for December 15, 1887. Other biographers give the 16th of August.

the circle of his associates to his teachers and fellow-students; and, pleading that his health required it, he put himself upon an exclusive milk diet. Some of his friends seem to have believed that his health was really giving way; and M. de Troncq, sending him a dish of gruel, advised him in 1763 to be temperate in his studies, and to believe that "a year longer on the earth is worth more than a hundred in the memory of men."

Among his particular friends was Guettard, who had been admitted to the Academy as a botanist in 1743, but had afterward devoted himself to geology and mineralogy. He had already traveled in France and other countries in the interest of a plan he had conceived for making geological maps, upon which the kind of soil, mines, and quarries should be indicated by special marks. In connection with Guettard, Lavoisier made extensive excursions during three years through different parts of France. At the same time he studied the gypsum of the environs of Paris, concerning which he presented, in 1765, the first of the valuable series of memoirs with which he was to enrich the journals of the Academy of Sciences during nearly the next thirty years. His investigation included the varieties of the mineral and their solubility in water, and the cause of the setting of plaster, which he was the first to explain.

The Academy having, in 1765, offered a prize of two thousand livres for an essay on "the best means of lighting at night the streets of a large city, combining clearness of illumination, facility of service, and economy," Lavoisier resolved to compete for it, and began at once a series of experimental studies on the subject. In order to make his vision more sensitive to slight differences in the intensity of light, he hung his room in black, darkened it, and confined himself within it for six weeks, without permitting himself to look upon daylight for an instant. The two thousand livres were divided by the Academy among three competitors, who had incurred considerable expense in their experiments, while it gave a special distinction to Lavoisier's memoir by awarding the king's gold medal to the author, for which a public session was given.

The geological excursions with Guettard were resumed immediately after the conclusion of this transaction. The intervals of leisure were given to reading, studying, and making notes; among the fruits of which was an inquiry into the matter of fire and the nature of its elements. At first Lavoisier fancied that air was only water reduced to vapor, or rather water combined with the matter of fire; but this gave way at once to the conception of an atmosphere having an existence of its own and containing the fiery fluid and water in solution. Guettard's plan for a mineralogical atlas of France having been adopted by Minister Bertin, Lavoisier was

invited to accompany him in a tour in the interest of that work to Lorraine and Alsace. Among the fruits of this journey was an extended memoir on the analyses of mineral waters, which was not, however, published during Lavoisier's life. The work of publishing the atlas on the original plan proving to be a larger one than the government was ready to sustain, Guettard retired from it, and Monnet, who was no friend of Lavoisier's, took his place. He used Guettard's and Lavoisier's material, added something of his own, and ignored Lavoisier, while recognizing Guettard, in his credits.

Other results of Lavoisier's earlier work were papers "On the Pretended Conversion of Water into Silica" (in which a prevailing error was refuted), "On a Species of Steatite," "On a Coal-Mine" (in conjunction with Guettard), "The Analysis of the Gypsums of the Environs of Paris," "Thunder," the "Aurora Borealis," "The Conversion of Water into the Condition of Ice," and "The Strata of Mountains" (general observations on the modern horizontal strata which have been deposited by the sea, and on the conclusions that can be drawn from their disposition relative to the antiquity of the terrestrial globe). The last was not published till 1789, when it appeared in the "Memoirs of the Academy."

Lavoisier was nominated in 1768 to succeed Baron in the Academy of Sciences, by Lalande, who proposed him on the ground that he had knowledge, talent, and activity, and possessed a fortune, which, relieving him from the necessity of embracing another profession, would enable him to be very useful to science. His principal competitor was Jars, an eminent metallurgist. Lavoisier was chosen, but the final decision rested with the king, and his minister decided that Jars should have the seat. Out of deference to the views of the Academy, a new position of adjunct chemist was provisionally created for Lavoisier, with the understanding that on the occurrence of the next vacancy in chemistry he should go in without a new election. The vacancy occurred through the death of Jars in the next year.

Desiring, as the biographers pleasantly express it, to place himself on a financial footing in which he could pursue, independently, investigations involving costly expenditures, Lavoisier sought and obtained in 1768 a position as one of the farmers-general (of the revenue). He conscientiously performed the duties of his office; instituted reforms in taxation by removing useless duties, and earned the gratitude of the Jews of Metz by freeing them from an odious impost. M. Grimaux represents him as performing the duty of making regular tours of inspection, with which he associated the study of the features of scientific interest which the places he visited might afford. The work of this office brought

him into association with farmer-general Paulze, whose daughter he married, and who went with him to the scaffold. In 1776 Turgot made him inspector-general of powder and saltpeter. In this capacity he made great improvements in the manufacture, so that, while he put a stop to forced official searches for saltpeter in the cellars of private houses, he quadrupled the product of the salt, and so increased the explosive force of gunpowder that the French brand became as much superior to the English as it had been inferior.

Lavoisier's great work consisted in the discovery of the true functions of oxygen and the nature of combustion; the determination of the relations of the solid, liquid, and gaseous states of matter; and in many other observations that embodied the germs of what have become since the leading principles of chemical science. Oxygen was detected at about the same time by Priestley, Scheele, and Lavoisier; but the phlogistic theory of combustion possessed the minds of chemists, and, although Eck de Suchbach and Jean Rey had already dimly discerned the truth, no one had paid any attention to their discoveries, and Lavoisier was working on what was to him, and substantially to the world, virgin ground. "Fixed air" and "combustible air" had been speculated upon, and "the air that is left after combustion" had attracted attention. But the phenomena of this kind, inconsistent as they were with the phlogistic theory, had not been sufficient to overthrow it. The first germ of Lavoisier's theory on these matters was embodied in a sealed packet which he deposited with the Academy in 1770. Recognizing that the calcination of metals could not take place without the access of air, and that the freer the access the more rapid the calcination, he "began to suspect," as he expresses himself, that some elastic fluid contained in the air was susceptible, under many circumstances, of fixing itself and combining with metals, and that to the addition of that substance were due calcination and the increase in weight of metals converted into calxes. From this thought came, after much groping with erroneous conclusions, the idea that air is a compound containing a vital part and another part, and that it is the vital part that is absorbed. The behavior of charcoal when burning in oxygen pointed to the nature of that substance and to the true theory of combustion. This new vital substance, which, uniting with metals, formed calxes, and with other substances generated acids, he called *oxygen* or the acid-producer; the air that was left after combustion was *azote*, or lifeless. The inflammable air which, combining with oxygen, was found to form water, was called *hydrogen*. Upon these facts, and with a few other names of known substances, Lavoisier constructed the system of chemical nomenclature which, after having undergone many modifications to conform to

new discoveries, still rules. The "muriatic radicle" gave Lavoisier some trouble, for he could find no oxygen in muriatic acid, and his experiments upon it with oxygen resulted in the production of a neutral substance which must be its calx; and so he called chlorine oxidized muriatic acid. Such mistakes were natural in the early days of chemistry. The decomposition of volatile alkali, or ammonia, by Berthollet, led to the suggestion which Lavoisier gave out with great modesty, that many earths, still regarded as simple, might be compound; and that their apparent indifference to oxygen should be attributed to their being already saturated with it.

On the nature of gases and vapors, which had not been understood before, Lavoisier asserted, in a memoir published in 1777, that most bodies were capable of existing in three different states —those of solids, liquids, and vapors, or aëriform fluids. The terms airs, vapors, and aëriform fluids express only a single form of matter—a class of bodies infinitely extended; and this principle "gives the key to nearly all the phenomena relative to the different kinds of air and to vaporization." While heat tends to change volatile bodies into vapor, the pressure of the air has a contrary effect; and "the tendency of volatile bodies to evaporate is in direct ratio to the heat to which they are exposed, and inverse to the weight or pressure brought to bear upon them." Lavoisier's memoirs on heat, expansion and contraction under changes of temperature, and latent heat, show an insight into the accepted principles. He discussed with much sagacity the question whether heat is a fluid or a force; and it would not be hard, for one who is determined to look for it, to find in his essays on this subject a prevision of the current constitutional chemistry. Lavoisier's later labors were physiological. They include papers on the production of carbonic acid in respiration and the office of the lungs in the process, in which the present theory is proposed as a secondary hypothesis, and on cutaneous transpiration. In his physiological studies, M. Dumas has found that he had arrived at a remarkable anticipation of modern views concerning the relations of organic to inorganic nature.

Lavoisier carried his energy into several other fields, and made his mark in all. He cultivated an estate of two hundred and forty arpents in the Vendôme, and in nine years doubled its production. His name is associated with a number of propositions looking to the public welfare or economical reform. In 1789 he presented in the National Assembly a report of the "Caisse d'Escompte," to which he had been attached for one year. As commissioner of the treasury he proposed in 1789 a new plan for the collection of imposts, which he elaborated in a special essay entitled "The Territorial Wealth of the Kingdom of France," a work which, accord-

ing to M. F. Hoefer, in the "Biographie générale," gave him a place in the front rank of the economists of his time. He participated in the work of the commission on a new system of weights and measures. As treasurer of the Academy he set the accounts and inventories in order, and discovered some forgotten funds of the institution, and made them available. "In short, Lavoisier was to be found everywhere; and his facility and zeal, equally admirable, were adequate for everything."

On the 2d of May, 1794, twenty-eight of the farmers-general, of whom Lavoisier was fourth on the list, were accused in the Convention of conspiring with the enemies and against the people of France. On the 6th of May they were all condemned to death, and on the 8th were executed together. Lavoisier and his friends hoped that his great scientific eminence and the undoubted useful character of his career might be brought to bear to save him. Some efforts were made to exert such influence. Lavoisier himself drew up a memoir of what he had done for the Revolution. The Bureau of Consultations presented a detailed report on his labors. A deputation of the *Lycée des Arts* visited him at the *Conciergerie*, bearing "to Lavoisier, the most illustrious of its members," a testimonial of its admiration.

Lavoisier left no children. He is described as having had a pleasing, intellectual face, and having been of large figure and of pleasant, sociable, and obliging disposition.

His most important works were: "Opuscules physiques et chimiques" ("Physical and Chemical Worklets," 1774), "Méthode de Nomenclature chimique" ("Method of Chemical Nomenclature," 1787), "Traité élémentaire de Chimique" ("Elementary Treatise on Chemistry," 1789). A complete edition of his works, published by the French Minister of Public Instruction, 1864–'68, included these books, fifty-eight memoirs communicated to the Academy of Sciences between 1770 and 1790, and numerous notes, letters, and reports relating to the various affairs in which he was engaged. He had himself begun to prepare a collection of his works, the completed portions of which were published by his widow in 1805 in two volumes entitled "Mémoires de Chimie."

CONSUMPTION, according to Dr. Irving A. Watson, prevails in all parts of New Hampshire, but is apparently influenced by topographical conditions. It is more prevalent at a low elevation with a maximum soil moisture than in the higher elevations with a less moist soil. The season has only a small influence upon the mortality from the disease; the mortality is considerably greater among women, and no age is exempt from it; but the least liability to contract it exists between the ages of two and fifteen, and the greatest between twenty and thirty. The death-rate is relatively much the larger among the foreign-born.

EDITOR'S TABLE.

THE JOHNSTOWN DISASTER.

AMONG the published sermons of the Rev. John Wesley is a famous one on "The Cause and Cure of Earthquakes." The cause of earthquakes, according to the eminent divine, was national unrighteousness, and their cure would be found to lie in national reformation. It was, in his opinion, of slight importance to know what physical causes or conditions were concerned in the production of earthquakes; seeing that, when the Almighty proposed to use them for purposes of national chastening, they would always be forthcoming; and when he willed to hold them in abeyance they would not happen. In the case of railway and steamboat accidents we have often been pointed to alleged Sabbath desecration by the railway and steamboat companies as the underlying causes of the calamities. Speaking generally, there have never been lacking those who could interpret every grave occurrence in such a way as to reveal their own familiarity with the special designs of Heaven. In the face of such explanations any reference to secondary or mediate causes seemed superfluous, if not profane. Lord Palmerston incurred much theological odium for suggesting that thorough sanitary measures might be more effectual than prayer in averting cholera from Great Britain; or that, at least, it might be well to try such measures before appointing a day of national humiliation. Down to the present time it has been customary, throughout a large part of society, to let the theological view of all personal bereavements dominate the natural. From one point of view the effect of this has been beneficial; from another it has been quite the opposite. It has been beneficial as affording, in effect, a vindication of the natural order of things and disposing men's minds to resignation and fortitude. It has been the opposite of beneficial in diverting attention from the proximate causes of painful visitations, and so far diminishing the sense of personal responsibility in connection with such things. That mankind would much earlier have acquired the power of combating the various forms of disease successfully, had theological prepossessions been absent, no candid and reasonable person could well deny.

The effect of the Johnstown disaster will be, if we mistake not, to bring into needed prominence the two ideas of the supremacy of natural law and the dependence of human life upon a wise adjustment by society itself of means to ends. No other *general* lesson is deducible from the sad circumstances of the case. Whatever may have been possible in John Wesley's time, it is hardly possible to-day for any leader of opinion to maintain that the disaster should be regarded as a divine dispensation. The preacher of the Brooklyn Tabernacle himself, who in most matters generally manages to express the most belated view, has openly refused to interpret this calamity as a sign of divine anger; being able, as he states, to affirm of his own knowledge that many of those overtaken by sudden death were among the best people in the country. Then let the lesson which the facts so powerfully teach be taken to heart. Not by righteousness of life, not by religious zeal, not by personal piety or devotion, not by anything that does not directly bear on the dangers to be averted or the benefits to be secured, will human life be protected from ill or enriched with good, so far as the order of things in the physical world is concerned. The prayer that is efficacious is the prayer that stimulates to work; and the work that is efficacious is that which is guided by

observation and reason. In one of the dispatches received by "The New York Times" from the scene of the disaster it was stated that some persons who had been rescued from the flood only to find themselves sole survivors of their families had abandoned all faith in Providence, and had emphasized their change of mind by casting away their Bibles. This affords an illustration of a kind of faith that never should have existed. These persons had evidently cherished the idea that, if they tried to live religiously, Providence would see that they did not suffer from the effects either of their own or of others' carelessness; and that natural agencies of a destructive character would in some mysterious way be instructed to pass them over, even while causing havoc all around. This expectation having been falsified by facts, their faith in the divine government is not only shaken but destroyed. Their standpoint is manifestly a less reasonable and noble one than that of the patriarch Job, who in the depth of his trouble could exclaim, "Though He slay me, yet will I trust him."

Herein lies a lesson for the clergy and for all teachers of youth. The only stable faith is one that reposes upon the order of nature, or at least that fully accepts that order, and is therefore prepared for all that may flow from it. The man who supposes that by any pious observances he can, to even the smallest extent, guarantee himself or his household from fire or flood, from pestilence, famine, or any form of physical disaster is virtually a fetich-worshiper. The pact he strives to make with the power he recognizes is of the nature of a private bargain, according to the terms of which exceptions to the general working of natural laws are to be made whenever his individual interests seem to require it. That man, on the other hand, has a rational faith which will never be put to shame, who, accepting the general scheme of things as something fixed, and preparing himself for all that may necessarily flow therefrom, strives to make the best possible life for himself and others. Such a man does not expect security if the conditions that guarantee it have not been fulfilled. He knows that pestilence *will* "come nigh his dwelling" unless sanitary measures are enforced in the neighborhood. He knows that vigilance is the price not only of civil liberty but of freedom from all the avoidable ills of life. He sees that the laws of life rightly observed are the source of abundant happiness, and that all that is needed to make life increasingly worth living is greater insight into the natural order of things, and a due inclination of the heart to do the things which the book of the law prescribes. It seems too much almost to hope that any adequate compensation can be found for so stupendous a disaster as that at Johnstown and in the valley of the Conemaugh; but the suffering and loss it has entailed will not have been wholly in vain if we can bring ourselves to regard the calamity as a great national object-lesson in the paramount necessity of placing human life under the safeguards that science is prepared to supply, and in the duty that devolves upon every individual in the community to contribute his own quota of reflection and action to the general welfare. One man, by a policy of masterly inactivity, re-established the falling fortunes of the Roman state: who knows what one man, by a resolute activity founded on common sense, might have done to avert one of the greatest calamities of modern times?

MENTAL GROWTH FROM MANUAL TRAINING.

THE new class of schools which includes in its course of study exercises for the hands has been much misunderstood, even by some who have undertaken the charge of such institutions. The phrase "manual training" in the names of these schools has conveyed the impression that hand-work is not only their

distinctive but their dominating feature. The true aim and the intellectual character of these schools are admirably presented in the article on "The Spirit of Manual Training," by Prof. C. Hanford Henderson, which opens this issue of the "Monthly." As Prof. Henderson shows, there is no school whose plan is so free from one-sidedness as the manual training school. "The specific purpose of such schools," he says, "is to offer an education that includes as far as possible all of the faculties. Its favorite maxim is, 'Put the whole boy to school.' Its mode of carrying out this purpose is the very practical one of occupying the time in any way, formal or informal, that will best lead to the end proposed." The chief danger which besets such a school is that of becoming a shop, and producing artisans rather than developing men. There are many who are not aware that any other effect follows from the training of the hands than the power to make certain articles. But not a finger can be consciously lifted unless an impulse is first sent to that finger from the brain. The bungling motions of unpracticed hands are due to the imperfect control of an undeveloped brain, and the gradual acquirement of the power to move the hands to just the right extent, in just the right direction, and with just the right amount of force, is accompanied by a proportionate development in the brain. The increasing sensitiveness of the eye to detect slight deviations from a perfect square, vertical, or circle carries with it a general ability to see accurately, and to rightly interpret the visual impressions presented to the mind. Manual training has also a higher influence. The boy takes a pride in his work, and, in overcoming the difficulties of his successive tasks, he develops the virtues of perseverance, self-reliance, and honesty. These schools are still in a formative stage, and doubtless imperfections and errors may be found in the character of any particular institution; but if the spirit which Prof. Henderson reveals shall dominate the manual training school, its book-study and its shop-work promise to form the best system of all-around educational development that has yet been devised.

BRUNO'S STATUE AT ROME.

THE erection at Rome of a statue to Giordano Bruno, who on the 17th of February in the year 1600 was publicly burned in that city for the heresies alleged to be contained in his philosophical writings, is a noble act of justice to the memory of a great and much-injured man. It is more than this, however, for it bears emphatic witness to the determination of the Italian Government and people to range themselves on the side of the widest freedom in speculation, and thus to place their whole civilization under the auspices and guidance of the modern spirit. It is satisfactory that, amid not a few partial signs of reaction, we have this great and formal vindication of the principle of intellectual liberty on the part of one of the leading nations of the world. When we read of the thousands of telegrams of sympathy sent to the Pope in connection with this event, we can not help wondering how the sympathizers, who, it may be presumed, all enjoy a fair measure of civil liberty in the countries throughout which they are scattered, would themselves like to be in the hands of a power that could bring them to the stake if their opinions were not of the pattern which that power chose to approve. From the modern point of view the execution of Bruno was simply the cold-blooded murder by ignorant fanatics of a man immeasurably their superior in knowledge and intellectual power; and who, by his refusal, in the face of death, to recant his opinions, proved himself possessed also of the highest degree of moral heroism. He was accused of atheism in his day, but his system of thought was pantheistic rather than atheistic. He believed that the

universe had an animating soul, which was diffused through every form of material existence, giving to each the powers and properties it was found to possess. He was a warm upholder of the Copernican system of philosophy; for adherence to which Galileo also suffered at a later date. He believed that the universe was of infinite extent and embraced an endless multitude of worlds. In a word, he had broken the fetters of ecclesiastical dogma, and had entered on a career of original speculation and research. No wonder he was considered a dangerous man, and that first the prison, and finally the stake, were his portion. Times, however, have greatly changed; and he who was led as a criminal to death for having dared to think for himself and uttered his thought, is now placed high on the honor-roll of the forerunners of modern liberty and civilization, and is gratefully remembered by thousands of intelligent men and women the world over.

LITERARY NOTICES.

THE ICE AGE IN NORTH AMERICA, AND ITS BEARING UPON THE ANTIQUITY OF MAN. By G. FREDERICK WRIGHT, D. D., LL. D., F. G. S. A. With an Appendix on "THE PROBABLE CAUSE OF GLACIATION." By WARREN UPHAM, F. G. S. A. With 147 Maps and Illustrations. New York: D. Appleton & Co. 8vo, pp. xviii and 622. Price, $5.

THE publication of "The Great Ice Age," by James Geikie, fifteen years ago, and of its second edition, revised, two or three years later, presented to the general reader a comprehensive and very interesting account of the Glacial period, the latest completed chapter of geologic history. In this, as in so many other portions of the geologic record, the most important recent contributions to knowledge have been gathered on this continent; and Prof. Wright, widely known for his extensive observations and fruitful investigations in glacial geology, has here set forth, in an attractive popular style, the vast array of evidence that an ice-sheet formerly overspread the northern half of North America, stretching southward to Nantucket, Martha's Vineyard, and Long Island, to the cities of New York, Cincinnati, and St. Louis, and on the Pacific coast to Seattle and Vancouver Island.

Conclusive proof that the drift deposits, bowlders, and strise found upon all the country farther north are due to the agency of land-ice seems to be supplied by the terminal moraines which were recognized only about a dozen years ago by Clarence King in the Elizabeth Islands on the south coast of New England, by Cook and Smock in New Jersey, and by Chamberlin in Wisconsin. Since then Prof. Wright has devoted every vacation and leisure day to the fascinating study of the drift, and has personally examined and mapped large portions of the glacial boundary along its extent across the eastern half of the United States, from Nantucket and Cape Cod through New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Missouri, Kansas, Nebraska, and South and North Dakota. This boundary traverses valleys, hills, and mountains, with surprising disregard of the contour, often rising or falling one thousand feet or more within short distances in crossing the Alleghany ranges.

Not content with these investigations, Prof. Wright went three years ago to Alaska, and there spent a month in observations of the Muir Glacier, which enters the sea at the head of Glacier Bay, terminating in water about six hundred feet deep, and rising above the water in a vertical cliff of ice a mile long and two hundred and fifty to three hundred feet high. The author's measurements showed that this glacier is pushed out into the bay at an average rate of forty feet per day, moving thus many times faster than the comparatively small glaciers of the Alps, though not surpassing the motion of Greenland glaciers, which similarly end in the sea, being there broken into icebergs and floated away.

Portions of Prof. Wright's exploration of the glacial boundary were done for the Geological Surveys of Pennsylvania and of the United States, the terminal moraine through Pennsylvania being traced by him in company with the late Prof. Henry Carvill Lewis. During these surveys, and in the visit to the Muir Glacier, many very instructive photographs were taken, which appear

as engraved illustrations in this volume. The author also presents very fully the results of the labors of others, both in the United States and in Canada, as Agassiz, Dana, E. and C. H. Hitchcock, Newberry, Le Conte, Lesley, White, Chamberlin, Salisbury, Todd, Gilbert, McGee, Shaler, Davis, Stone, Russell, Upham, A. and N. H. Winchell, Claypole, Spencer, Whitney, Sir William and G. M. Dawson, Bell, Chalmers, and many more, often quoting from their reports and memoirs, and reproducing their illustrations and maps. The work is thus a compendium, well brought up to date, of the already voluminous literature of this wonderful geologic winter of our globe.

Glaciers now exist, as described in this volume, on the Sierra Nevada, on Mount Shasta, in the Selkirk Range, and in great numbers and extent northward to Mount St. Elias and Unalaska. In the chapter on the glaciers of Greenland, a map shows the route of Nordenskiöld in 1883, and of Dr. F. Nansen last year upon the ice-sheet that covers its interior, extending in a vast monotonous expanse which rises gradually to elevations in its central portion six thousand to ten thousand feet above the sea. The further description of glaciers in other parts of the world, and of the antarctic ice-sheet, prepare the reader for the discussion of the signs of former glaciation in the now temperate regions of North America and Europe.

The striation of the bed-rocks, the striated pebbles and bowlders of the drift, sections of till and of stratified drift and loess, the characteristic topography of kames, terminal moraines, and the oval hills of till called drumlins, are very clearly described, with excellent illustrations from photographs. The boundary of the glaciated area from the Atlantic to the Mississippi is shown in a series of six maps; and a general map showing the glacial geology of the United States delineates, besides this southern limit of the North American ice-sheet and drift, the successive terminal moraines formed at times of halt or readvance of the ice during its retreat and final melting, the courses of the glacial striæ and transportation of bowlders, the driftless area of southwestern Wisconsin and portions of adjoining States, the modified drift deposited in valleys of southward drainage from the ice-sheet, and the boundary of the glacial Lake Agassiz which was held in the basin of the Red River of the North and of Lake Winnipeg by the barrier of the ice while it was being melted away.

Important changes in the drainage of the country, caused by the ice-sheet and its drift deposits, are noticed in considerable detail. In the same way that Lake Agassiz was formed, outflowing by the glacial River Warren along the course of the Minnesota and Mississippi Rivers, the Great Lakes of the St. Lawrence were held by the receding ice-barrier at levels much higher than now, similarly outflowing over the lowest points in their southern water-shed to the Mississippi; and these ancient lake-levels are still found distinctly marked by beach ridges and deltas of gravel and sand. Another very interesting glacial lake was formed in the basin of the Ohio River by the temporary dam of the ice-sheet, which at its time of maximum area extended across this river at Cincinnati, carrying its morainic drift into the northern edge of Kentucky. "These glacial deposits south of the Ohio," according to Prof. Wright's observations, "are such as to make it certain that the front of the continental glacier itself pushed, at some points, seven or eight miles beyond the Ohio River; and it is altogether probable that for a distance of fifty miles (or completely around the eastern, northern, and western sides of the Kentucky peninsula formed by the great bend of the river) the ice came down to the trough of the Ohio, and crossed it so as completely to choke the channel and form a glacial dam high enough to raise the level of the water five hundred and fifty feet —this being the height of the water-shed to the south." Traces of the former existence of this Lake Ohio are found along a distance of about four hundred miles in the valleys of the Ohio, Alleghany, and Monongahela Rivers and their tributaries. At the present time the abundant lakes, and the waterfalls on streams, throughout the glaciated area, so remarkably contrasted with their general absence farther south, are due to irregularities in the deposition of the drift and to its obstructions of the preglacial drainage.

A chapter is devoted to the flight of plants and animals during the Glacial pe-

riod, species from far north having been driven southward by the severe climate and accumulating ice, as is shown by remnants of a flora and fauna like those of the arctic regions, which have managed to continue their existence since the Ice age on the tops of mountains in temperate latitudes. Many peculiarities in the distribution of forest trees, made known by the researches of the late Prof. Asa Gray, also find their only adequate explanation in these vicissitudes of climate.

Northwestern Europe was covered by an ice-sheet about half as extensive as that of our own continent, and the author gives on a single map a comparative view of the glaciated areas of both. Another map shows the course of the terminal moraines recently traced by Lewis in Ireland, Wales, and England, and by Salisbury in Germany, each of whom had much previous experience from work on glacial geology in the United States.

Treating of the cause and date of the Glacial period, Prof. Wright rejects the astronomic theory of Croll and Geikie, which attributes the severe climate to conditions dependent on the eccentricity of the earth's orbit between two hundred and forty thousand and eighty thousand years ago. Instead of this, the post-glacial erosion of the gorge below the Falls of Niagara and of that extending eight miles on the Mississippi from Fort Snelling to the Falls of St. Anthony at Minneapolis, similar erosion by streams tributary to Lake Erie, changes in the shores and deposits of dune sand about Lake Michigan, and other observations, afford much shorter measures of the time since the departure of the ice-sheet, agreeing in their testimony that it was no longer ago than seven to ten thousand years. Prof. Wright is also disposed to doubt that there have been two distinct Glacial epochs in America, and believes that the facts thus far obtained are capable of explanation on the theory of but one epoch, with the natural oscillations accompanying the retreat of so vast an ice-front.

The last two chapters review the evidences of man's presence in America and Europe during the Glacial period, specially describing the important discoveries of paleolithic implements in glacial gravel deposits near Trenton, N. J., by Abbott; near Claymont, Del., by Cresson; in the Little Miami Valley, Ohio, by Metz; and at Little Falls, Minn., by Miss Babbitt. But doubts remain concerning the authenticity of the famous Calaveras skull and stone implements denoting a higher state of development than that of paleolithic man, reported as occurring in the lava-covered gold-bearing gravels of California, which, if obtained there in the undisturbed gravel, would give to our race a considerably greater antiquity than is otherwise known.

In the appendix Mr. Upham contributes "an explanation of the causes of the Glacial period, which, in this application of its fundamental principle, seems to be new, while in its secondary elements it combines many of the features of the explanations proposed by Lyell and Dana and by Croll. Briefly stated, the condition and relation of the earth's crust and interior appear to be such that they produce, in connection with contraction of the earth's mass, depressions and uplifts of extensive areas, some of which have been raised to heights where their precipitation of moisture throughout the year was almost wholly snow, gradually forming thick ice-sheets; but under the heavy load of ice subsidence ensued, with correlative uplift of other portions of the earth's crust; so that glacial conditions may have prevailed alternately in the northern and southern hemispheres, or in North America and Europe, and may have been repeated after warm interglacial epochs." Mr. Upham believes that the earth's crust floats in a condition of hydrostatic equilibrium upon the heavier liquid or viscous mobile interior, or layer enveloping the interior, subject, however, to strains and resulting deformation because of the earth's contraction. But such oscillations seem not inconsistent with the doctrine that the earth's interior is solid, with a degree of mobility like that of ice in glaciers. Whether the formation of the Himalayan mountain-range has been contemporaneous and correlative with the Glacial period, and the Appalachian uplift with the Carboniferous and Permian glaciation of portions of the Eastern hemisphere, as is here suggested, must probably require many future years of observation and study to determine.

All who have read the earlier work of Prof. Geikie, or listened to Prof. Wright's

lectures on this subject before the Lowell Institute in Boston, and the Peabody Institute in Baltimore, will welcome this elegantly printed volume as the most elaborate and complete presentation of this marvelous geologic period. The broad and critical knowledge which the authors have gained through long field-work, the admirable literary style with which the complex facts are grouped and explained, the abundant illustrations by engravings and maps, and the copious index making the volume a convenient manual, will be sure to incite many to observe for themselves the records of the Ice age in the vicinity of their own homes.

THE FISHERIES AND FISHERY INDUSTRIES OF THE UNITED STATES. By GEORGE BROWN GOODE and a Staff of Assistants. Sections III, IV, and V. Washington: Government Printing-Office. Four Vols. Pp. 176, 178, 808, 887, with Plates and Charts.

THIS great work is designed to give a complete survey of all that relates to our fisheries, and includes in its portly volumes a vast amount of information on every branch of the subject. This information is presented, moreover, in a way to attract readers, notwithstanding its discouraging voluminousness, and invite them to keep on. The first part of the present installment, Section III, is devoted to a description of the "Fishing-Grounds of North America," and is edited by Richard Rathbun. The term "fishing-grounds" is defined to apply to "those areas of the sea-bottom which are known to be the feeding or spawning grounds of one or more species of edible fishes, and which afford fisheries of greater or less extent." The most important of our fishing-grounds are located off the eastern coast of North America, between Nantucket and Labrador; the most distant fields lying in Davis Strait off the coast of Greenland. These, with the other fields of the eastern coast down to Mexico, are described, under thirteen local or special headings, by Joseph W. Collins and Mr. Rathbun; the sea fishing-grounds of the Pacific States coast, by President Jordan; those of Alaska, with their resources, by Tarleton H. Bean; those of the Great Lakes, by Ludwig Kumlien and Frederick W. True. In addition, President Jordan furnishes a discussion of the "Geographical Distribution of Food-Fishes in the Several Hydrographic Basins of the United States." The text is supplemented by thirty-two "ocean temperature charts." Section IV comprises an account of "The Fishermen of the United States," by Prof. Goode and Mr. Collins, including the classification of their nationalities, their distribution, delineations of their mode of living, character, habits at work, intelligence, tastes, and other qualities. A feature of special interest is the section on the part played by "fishermen as investigators." In Section V, the "History and Methods of the Fisheries" are related in two very large volumes. The review of this part tends to take the form of an enumeration rather than an analysis. Nineteen authors are represented in the different papers. The accounts cover the history of the several fisheries described; their beginning, growth, or decay, and present condition; the methods pursued at the different grounds where each fishery is prosecuted; processes of preparation for the market; applications of the fish; statistics of returns and value; inquiry into the agencies which have affected the prosperity or existence of the fishing stations as such; and a variety of such other information as may help to a clear and comprehensive view of the condition and prospects of fishing enterprise. The first volume relates to food-fishes; the second to marine mammals, reptiles, and invertebrates which are used for food or other economical purposes. The special subjects are the halibut, cod, haddock, hake, mackerel, menhaden, herring and "sardine," Spanish mackerel, millet, red snapper, salmon, whale, blackfish and porpoise, Pacific walrus, seal and sea-otter, turtle and terrapin, oyster, scallop, clam, mussel and abalone, crab, lobster, crayfish, rock lobster, shrimp and prawn, leech and trepang, and sponge fisheries, industries, and trades; with special chapters on "The Shore Fisheries of Southern Delaware," the "Havana Market Fishery of Key West," "The Pound-net Fisheries of the United States," and "The Fisheries of the Great Lakes." In nearly every chapter may be found illustrations on the depreciation or destruction of fish-beds once extremely valuable and prolific, of the manner in which we have allowed great resources to go to waste through the reckless prosecution of speculative enterprises. One

volume of the series is an atlas of two hundred and fifty-five plates.

A Treatise on Co-operative Savings and Loan Associations. By Seymour Dexter. New York: D. Appleton & Co. Pp. 299.

The author has aimed, in preparing this treatise, to furnish information concerning the class of associations described in the title, in a form in which it shall be accessible to all desiring it; to explain clearly the principles on which the typical association is founded; to describe variations from the type; to furnish a complete and safe guide to persons wishing to engage in such associations; to correct certain false notions concerning some matters of financial management in them; and to publish the best statutes of the several States concerning them, recommending particularly the New York act of 1887 and the laws of Massachusetts. While co-operation has existed under various forms and for many purposes, the efforts in the special shape considered in this book have been more uniformly successful than in any other. The associations formed for the purpose have had various names—building and loan associations, building associations, mutual savings and loan associations, homestead aid associations or co-operative banks. The name given them by Mr. Dexter includes all the others, and is believed to describe them more accurately than any other name. The benefits derived from them are all included under the general description that they encourage savings. This they do by affording a safe place of deposit, convenient, but out of the reach of pressing temptations to spend; that the ultimate object of the saving, to provide a home, is made practicable through them; that through them an opening is offered for the investment of small sums that might otherwise be frittered away; and that they afford convenient facilities to their members wishing to negotiate loans. A chapter is devoted to the delineation of the typical association; another chapter to a sketch of the growth and spread of the organizations and accounts of their conditions in the several States—which is imperfect as a history because it has been impossible as yet to get full information on the subject. The development of the scheme on which the associations are conducted is reviewed, with the modifications it has undergone, and "the best scheme" is determined; and this review is followed by directions for the organization of an association under the New York act of 1887, and also under that of 1851, and by instructions in the keeping of the association's accounts—this being, in fact, the exposition of a particular system of bookkeeping. In the appendix are given the laws of New York, Pennsylvania, Massachusetts, and Ohio respecting the associations, and forms for a constitution and the papers required in the transaction of their business. The book supplies satisfactory information on a subject in which there is wide-spread interest, and answers well to the familiar description that it responds to a want of the times.

Annual Report of the Geological Survey of Arkansas for 1888. Vol. I. By John C. Branner, State Geologist. Little Rock: Press Printing Company.

Operations under the present survey were begun in 1887. When the first report was made, they had been carried on for so short a time that only a meager statement could be published; hence the result of most of the work that has been done from the beginning will be given in the four volumes of the current report. The present volume, after a brief general account of the work done during the year, is occupied with the report of Dr. T. B. Comstock, assistant geologist, upon his preliminary examination of the mineral resources of the western central part of Arkansas, with especial reference to the production of the precious metals. The second volume will give the results of the combined work of the United States Geological Survey, and the Geological Survey of Arkansas, upon the Mesozoic geology of the State. The third volume will relate to the coal regions; and the fourth volume will contain miscellaneous and local reports. Dr. Comstock's work, as described in the present volume, relates to Pulaski, Saline, Hot Spring, Garland, Montgomery, Polk, and Scott Counties, and parts of Yell, Pike, Howard, Sevier, and Franklin Counties. The observations recorded were made in 1887 and 1888 in all the important places in the State where mining or prospecting for gold and

silver were or had been carried on, and were also directed to a certain extent to the occurrence of the baser metals. After describing the surface geology and the mines of the counties named with considerable fullness, the author summarizes his conclusions that there is but little reason to believe that any workable deposits of gold occur in the State. The promise is better, though not brilliant, for silver; and much of the profit to arise in the working of the silver ores is likely to ensue from the presence of other metals, chiefly lead and zinc, with which the silver ores are closely linked. Other metals looked for were copper, which does not probably exist in deposits that can be profitably worked; tin, of which there is one slight indication; nickel and cobalt, of which one "claim" is mentioned that "deserves development"; manganese, which exists in considerable amount; iron, in ores the quantity and quality of which do not appear to have been definitely determined; and miscellaneous products, such as graphite, silica powder, pyrites, and mineral paints. A list of the minerals of western central Arkansas, and a chapter on the location of mining claims, complete the volume.

A Handbook of Cryptogamic Botany. By Alfred W. Bennett, F. L. S., and George Murray, F. L. S. London and New York: Longmans, Green & Co. Pp. 473. Price, $5.

This work fills an important gap in our botanical literature, for, while we have, on the one hand, numerous elaborate monographs dealing with special families or groups of cryptogams, and, on the other, our general treatises on botany give a sketch of the cryptogamic series, there is no book in the English language devoted to presenting the main facts of cryptogamic botany as they are known at the present time. The first subdivision treated is the vascular cryptogams, including fossil forms, and embracing six classes. In this subdivision and the *Muscineæ*, the classification adopted by the authors follows generally accepted principles. In the Thallophytes, however, where, on account of less complete knowledge, there is less general agreement, the systems are numerous, and the authors state that in choosing among them they have made an effort to bring together those organizations which are most nearly related to one another. To this end, while they adopt the *Protophyta* of Sachs as a primary class, they differ from that authority in holding to the older division of the higher Thallophytes into the two great groups of *Algæ* and *Fungi*. Besides those already mentioned, the two small groups, *Characeæ* and *Mycetozoa*, make up the seven chief subdivisions employed in this work. The language of the treatise is clear and smooth, and the authors have striven toward a simple terminology in their department by using such Anglicized forms of Latin and Greek terms as *sporange*, *archegone*, *antherid*, *epiderm*, etc. The text is illustrated by nearly four hundred excellent illustrations; lists of the literature of the several groups, classes, or orders are inserted at the appropriate places; and the volume is adequately indexed.

The Tree of Mythology, its Growth and Fruitage: A Study. By Charles De B. Mills. Syracuse, N. Y.: C. W. Bardeen. Pp. 288.

This work, which is declared to be the fruit of a love for the subject, seeks to ascertain something of the origin, nature, and growth of myth, what it primarily was, and what has come of it. The theme can not, in the author's view, be said to have become obsolete, "when the bale-fires are still kindled, as in Scotland and Norway, on each return of the solstice; when the peasant, as in Germany, still fodders wind and flame in deprecatory offering, and hunts on St. John's night the witches from house and stall; when, as in our own country, the superstitious regard for signs, omens, etc., still holds so strongly even in intelligent and comparatively freed minds, and survivals almost innumerable of old mythological beliefs exercise, to this hour, powerful sway over both opinions and conduct." The origin of myths is sought by the author chiefly in the disposition of childhood, "and so the child-mind of humanity," to view every object about it as having conscious life; as endowed, in some strange or vague way, with personality. Combined with this is a propensity to exaggerate, particularly in matters associated with the religious sentiment. Thus the illusions of mythology grew as the original

appellative sense of words descriptive of objects in nature was lost, and the anthropomorphism and personification became more and more complete. From this general description and origin the author goes on to account for "myths of explanation," "myths arising from metaphor," "heroic legends," "nursery tales," "proverbs, folk-lore," etc., "survivals and reminiscences," "shadow and signification," "didactic and ethical myths," and "symbolism." Finally, he forecasts an "excelsior" for the human mind, when it shall grow beyond "anthropomorphism in reference to Deity?"

The book prepared by *Paul Bert* as an introduction to his "First Steps in Scientific Knowledge" has been translated and issued in this country, with the title *Primer of Scientific Knowledge* (Lippincott, 36 cents). The author says of the present volume: "This new work is carried out in the same spirit as the former and follows the same plan. The book is so arranged that the larger work becomes a review and extension of the subject. The method which consists in presenting to the child during two or three consecutive years the same subjects, in the same order, following the same general arrangement, but with an increasing number of facts and a progressive elevation of ideas, is an excellent one and is now universally adopted." The "Primer" is both more elementary and more practical in character than the "First Steps." It treats of man (his organs and their uses), animals, plants, stones, and the three states of matter, with a few paragraphs on light, sound, electricity, and magnetism. Reading lessons and subjects for composition are given at the end of each section. The book is full of pictures and is provided with a glossary. These two books serve admirably to bring the study of nature into the early education of pupils, where it will do them most good.

A very attractive little book, entitled *Outlines of Lessons in Botany*, is offered by *Jane H. Newell*, for the use of teachers, or of mothers studying with their children (Ginn). The lessons here outlined are suitable for children of twelve years of age and upward. They follow the plan of Dr. Gray's "First Lessons" and "How Plants Grow," and are intended to be used in connection with either of those books. The necessary references are given at the end of each section. These lessons contain directions for getting plants to work upon by raising them from the seed, etc.; also suggestions for leading the pupils to observe and to experiment for themselves. Part I, now before us, deals with the organs of plants and their functions, taking up in succession roots, buds and branches, stems and leaves, and thus affords a basis for classification, which Part II, on flowers, is to develop. A general description of seedlings precedes the chapters on the special organs, and prefixed to that is a brief account of plants and their uses. Only the flowering plants are studied in these lessons. The book has twenty-five illustrations.

Prof. Wentworth's series of mathematical text-books has been increased by the first volume of a work on *Algebraic Analysis*, by *G. A. Wentworth, J. A. McLellan, and J. C. Glashan* (Ginn, $1.60). This work is intended to supply students of mathematics with a well-filled storehouse of solved examples and unsolved exercises in the application of the fundamental theorems and processes of pure algebra, and to exhibit to them the highest and most important results of modern algebraic analysis. It may be used to follow and supplement the ordinary text-books, or as a work of reference in a course of instruction under a teacher. The present volume ends with a large collection of exercises in determinants.

Studies in the Outlying Fields of Psychic Science, by *Hudson Tuttle* (Holbrook, $1.25), is an attempt to explain those occurrences which have come to be known by the name of psychic phenomena. His theory is, that there is a psychic ether which conveys thought as the luminiferous ether conveys light; that every one's thoughts produce waves in this psychic ether, which may be felt by a person at a distance who has the requisite sensitiveness, and that in this way mesmerism, clairvoyance, mind-reading, visions, thought-transference, etc., are made possible. He regards this theory and these phenomena as furnishing a scientific basis for the belief in immortality. The closing chapter is a record of impressions which the author believes he received from the spirit-world. Mr. Tuttle appears to be acquainted

with the physiological explanations of hallucination, the influence of the mind upon the bodily functions, and allied phenomena, and he accepts some and rejects others according as they happen to run with or counter to his speculations. Other results of scientific research he treats in the same arbitrary fashion.

The second volume to appear in the four-volume history of English literature, which is being published by Macmillan & Co., is *A History of Eighteenth Century Literature* (1660–1780), by *Edmund Gosse*, M. A. ($1.75). The first great writer of this period is Dryden, and the other prominent names which come in the scope of the present volume are Pope, Swift, Steele, Addison, Defoe, Richardson, Fielding, Smollett, Johnson, Hume, Goldsmith, and Gibbon, the period ending with Fanny Burney, Junius, and Burke. In regard to the critical opinions expressed in the work the author says: "In every case I have attempted to set forward my own view of the literary character of each figure, founded on personal study. Hence, in a few cases, it may be discovered that the verdicts in this volume differ in some degree from those commonly held. A few names which are habitually found chronicled are here omitted, and still fewer which are new to a general sketch are included. . . . In the final chapter I have stated my theory with regard to the mode in which the philosophical, theological, and political writing of the period should be examined. But I may explain here that it has been my object, while giving a rough sketch of the tenets of each didactic specialist, to leave the discussion of those tenets to critics of the specialist's own profession, and to treat his publications mainly from the point of view of style." The work is provided with an index, and a brief bibliography designed to refer the student to the most accessible text of the chief writers mentioned.

Schiller's Jungfrau von Orleans, edited by *Benjamin W. Wells* (Heath, 65 cents), has been adapted for the class-room by a copious accompaniment of notes and other information. The text is prefaced by an introduction of fifteen pages dealing with the composition of the drama, editions and manuscripts, meter and rhyme, and the divergence of the play from history, and includes some biographical notes on the historical characters in the drama. The text has a clear, attractive look, although the stage directions and foot-notes are in rather small type for German print, which is trying enough to the eyes even when large. Thirty-eight pages of notes—grammatical and historical—are appended.

Prof. *B. Perrin's* edition of *Homer's Odyssey*, Books I–IV (Ginn & Co.'s "College Series of Greek Authors," $1.50), is based on the edition of Karl Friedrich Ameis and C. Hentze, with adaptation to what the editor believes to be the requirements of American college classes. Considerable material has been furnished for the higher criticism of the poem, in which the first four books are of special significance. At the same time, enough assistance of an elementary sort has been provided to enable a good teacher to use the volume in introducing students to the study of Homer. Certain interpretations characteristic of the Ameis-Hentze edition have been retained in the current notes, while the editor expresses in the appendix his preference for other views. On the other hand, he has incorporated in the notes views at variance with those of the German edition. Variations in the manuscript, readings of other editors, and other data appropriate to a text-book of the kind, are given in the appendix.

John Chardaxes (John B. Lippincott Company, $1.25) is a tale of the civil war in North America, by *Peter Boylston*, an author whose identity is left indefinite in a prefatory note by his "literary executor." The plot affords room for considerable variety of situation and incident, and the management is lively. The history of the title character is invested with a degree of mystery which adds to the interest and complexity of the story; and a negro woman from the slave-markets of the South, having decided individuality of character, is introduced with some skill.

The Beginner's Reading-Book, by *Eben H. Davis* (Lippincott, 42 cents), starts with short sentences, in both script and Roman type; new words are not arranged in columns on the page, nor does the alphabet appear by itself in the book. The "Teacher's edition" contains a chapter on how to teach reading, in which the teacher is advised to

exercise the pupils in talking about objects, and in reading from the blackboard, before putting the reader into their hands. Pictures of the objects named accompany most of the lessons, and when long sentences are reached they are broken into short sections at natural pauses, each standing in a line by itself, in order that the pupil's mind may not be required to take in too much at once.

Dr. *Mary Putnam Jacobi* has published, under the title *Physiological Notes on Primary Education and the Study of Language* (Putnam, $1), four essays, of which three appeared in "The Popular Science Monthly" for 1885 and 1886, and the fourth in "The Teacher" during 1888. Two of these essays describe "An Experiment in Primary Education," being a record of the method employed in training the intellectual faculties, especially the perception and memory, of a child between the ages of four and six and a half years. The next essay, entitled "The Flower or the Leaf," is a reply to a criticism by Miss E. A. Youmans on the method of teaching a knowledge of plants employed in the afore-mentioned "Experiment." The subject of the paper which concludes the volume is "The Place for the Study of Language in a Curriculum of Education," and embraces a consideration of what special influence language study has upon mental development, what is the age at which this influence should be exerted, and what relative proportion language and other subjects should have in a general curriculum.

One might suppose *The Geography of Marriage* (Putnam, $1.50) to be a survey of the diversified natural features of the state of matrimony. But, under this title, Mr. *William L. Snyder* offers a law-book written in such a popular style as to make it, aside from its subject, attractive and useful to the lay reader. In a score of chapters he compares the provisions of the marriage and divorce laws of the States of the Federal Union as to who may marry, what constitutes a valid marriage, clandestine and runaway marriages, bigamy, divorce, and various other features of the subject, taking occasion to point out the evils arising from the differences among these laws in different parts of our country. Of the two ways of securing a uniform law which have been proposed, he favors concerted action by the States rather than a constitutional amendment giving up the control of this matter to Congress. A summary of the marriage and divorce laws existing in this country, arranged by States, concludes the volume. The index, which covers the general part of the book tolerably, is very meager with respect to this summary.

The fifth volume in the series of "English History by Contemporary Writers" tells the story of *The Crusade of Richard I* (1189–'92), and the materials were selected and arranged by *T. A. Archer* (Putnam, $1.25). There is an ample number of accounts of this expedition, some by contemporary writers who were in Palestine when the events narrated occurred; others by contemporaries who remained at home; and still others by writers of the next generation, some of whom had visited the scenes of the crusade. Accounts of the authors and books from which extracts are taken, and notes on various customs and things of the time, are appended to the volume. Pictures of war-engines, fortresses, etc., illustrate the text. The volume lacks an index.

Mr. *D. H. Montgomery* has made a book which claims to embody *The Leading Facts of French History* (Ginn, $1.25), and is evidently intended to serve either as a text-book or for general reading. It begins with a reference to the cave-men and the latest event which it records is the election of President Carnot. The narrative is popular and picturesque in style, and is enlivened with numerous anecdotes. Many additional bits of information and the pronunciation of all difficult names are supplied in foot-notes. Fourteen maps, mostly in colors, show the changing boundaries of France throughout the history. A list of dates, a genealogical table of French sovereigns, and a list of books on French history, are appended to the volume.

Six Species of North American Fishes, published by the Smithsonian Institution, under the head of "Natural History Illustrations," contains representations of the figures and details of five species of minor fresh-water fishes and the pickerel, as they were prepared under the direction of Profs. Agassiz and Baird, from drawings by A. Sourel, with explanations by President

David Starr Jordan. The publication is made "as a memorial of a project undertaken early in the history of American science, by two of the most eminent naturalists this country has ever possessed."

A full and valuable paper on *The Cave Fauna of North America* is published by Prof. A. S. Packard, from the memoirs of the National Academy of Sciences. It contains descriptions of the caves, with notes on their hydrography, temperature, origin, and geological age; the source of the food-supply of their inhabitants; the probable mode of colonization; with lists of the species inhabiting the better-known caves. This general introduction to the subject is followed by more special articles on the vegetable life of the caves; a systematic description of the invertebrate animals found in them; a systematic list of the cave animals of North America; geographical distribution of the cave species; lists of American and European cave animals and of blind non-cavernicolous animals; anatomical studies; a discussion of the origin of the cave species and genera; and a bibliography. To all these are appended twenty-seven plates of illustrations.

The seventh series of the "Johns Hopkins University Studies in Historical and Political Science" is devoted to social science, education, and government. The first number is a sketch, by *F. C. Montague*, of *Arnold Toynbee*, a tutor at Oxford, and an earnest and practical advocate of political, economical, and ecclesiastical reform, and of measures for improving the condition of the masses, who died in 1883, in his thirty-first year. Accounts are added of "The Work of Toynbee Hall," which is named after him, and in which the effort is made to further what he had at heart, and of "The Neighborhood Guild in New York"—the former by P. L. Gill, and the latter by the Rev. Charles B. Stover. The second and third numbers present the history of *The Establishment of Municipal Government in San Francisco*, by Prof. *Bernard Moses*, of the University of California. The history begins with the foundation of the Spanish *pueblo* in 1776, and is considered in three "somewhat clearly defined periods": those of Spanish settlement and stagnation; of transition, extending from the conquest to the adoption of the charter of 1850; and the third period, ending with the adoption of the charter of 1851. No. 4 is *The Municipal History of New Orleans*, by *William W. Howe*. It begins with the foundation of the town in 1718, and traces the gradual development of the municipal organization and its vicissitudes under the changes of jurisdiction which the Louisiana Territory suffered, with the experiments in charter-making that marked the career of the American city, down to the adoption of the present charter in 1882. To this are added notices of the fire department, Commission of Public Works, and water and gas supply, and accounts of the charitable gifts that have been made to the city, and the voluntary public associations. The sixth and seventh numbers embrace a sketch of *English Culture in Virginia*, by Prof. *William P. Trent*, of the University of the South. The paper consists chiefly of a study of the letters of Francis Walker Gilmer, one of the most active of the Virginia gentlemen of the old school for the advancement of education, who was also considerably distinguished in his day for literary achievements—and an account of the English professors obtained by Jefferson for the University of Virginia.

No. XXV of the *Economic Tracts of the Society for Political Education* (330 Pearl Street, New York) is a pamphlet on *Electoral Reform*. In it the purposes of those persons who are seeking to withdraw the control of the distribution of ballots from partisan manipulators and lodge it with public officers, and to secure a really secret and independent vote, are explained; the objections to their proposed system are answered; the operation of the Australian system is described; and the text of the Massachusetts ballot-reform act and the New York Saxton bill are given in full. No. XXVI of this series is *The Liquor Question in Politics*, by *George Iles*. It deals with the growing and alarming power of the liquor traffic, and with the efforts of various forms to restrain it, gives clear and impartial analyses of the propositions and arguments of the advocates of "regulation" by high license, and of the prohibitionists; and contains summaries according prominence to peculiar features of the more recent anti-liquor legislation in several States. Mr. *O.*

J. Smith, 30 Vesey Street, New York, in a pamphlet entitled *Is all well with us?* assumes that we have not politically degenerated from any standard of our ancestors, but are quite as pure as they; and, admitting the existence and hold of the spoils system, maintains that it is a legitimate and direct fruit of the restrictions imposed in the Constitution of the United States upon freedom and elasticity of legislative action. He believes that, to get rid of it, our form of government must be so modified that the will of the people may find certain and immediate expression in law.

The Teacher's Outlook, edited by *W. G. Todd* (Des Moines, Iowa), is a monthly magazine, devoted to general literature, science, health, and industrial and national affairs. Its peculiar feature is a semi-coöperative plan of publication, under which teachers are invited to become stockholders under certain easy conditions; when they are enrolled on the list of contributors, and are entitled to send one article each year for publication (if it be found suitable), for which they receive another share of stock.

The American Workman, published for *O. M. Dunham* by Cassell & Co., is "an illustrated weekly magazine of practice and theory for all workmen, professional and amateur. Its purpose is to furnish articles, with designs, for various kinds of work, particularly such as an amateur might incline to undertake. The half-dozen numbers on our table contain, on their first pages, articles with views and diagrams on "A Cabinet in Fret-cutting," "A Drawing-room Overmantel," "A Cheap, Strong, and Tasteful Method of binding Pamphlets, Music, etc.," "Wood-Carving," "Saw Filing and Setting," "A Summer Fitment for the Fireplace," etc.; and the other pages are occupied with similar matter.

In *The Story of William and Lucy Smith*, edited by *George S. Merriam* (Houghton, Mifflin & Co.), are presented the life and thoughts of a literary man whose career was distinguished by creditable work through forty years, but who did not acquire fame. "He was a man of genius and rare fineness of nature; the associate in early years of Mill, Sterling, Maurice, and Lewes," of Samuel Warren, and of Grove, author of "The Correlation of Physical Forces." He became a contributor to "Blackwood's Magazine" in 1839, and was regularly represented in its pages—as literary reviewer, and in essays embodying philosophical thought—till his death in 1871. His contributions were mostly anonymous; no collection of his papers was made; and this book is published to exhibit his best work, in dramatic, critical, and philosophical writings. His best and best-known work was "Thorndale, or the Conflict of Opinions," published in 1857; after it was "Gravenhurst, or Thoughts on Good and Evil," 1862. Lucy Smith was his wife, and his mate in the best sense of the word. The book is divided into three parts, covering Mr. Smith's bachelor life, the joint married life of the couple, and Mrs. Smith's widowhood. It bears the character of a tribute of admiration, as well as of literary analysis, and its interest is literary and psychological.

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POPULAR MISCELLANY.

Science-Teaching in Schools.—The report of the Committee of American Naturalists, on a scheme of instruction in natural science to be recommended to the schools, advises that instruction should begin in the lowest grades of the primary schools, and continue through the whole course. It should be chiefly by object-lessons in the lowest grades, but should be more systematic in the high schools; and an elementary, but genuine and practical, acquaintance with one or more departments of natural science should be required for admission to college. The main part of the scientific work should be given in the lower schools to the study of

plants and animals; the botanical instruction beginning with such exercises as drawing and describing various forms of leaves, and advancing to flowers of gradually increasing difficulty. In zoölogy, the most familiar animals, and those which the pupils can see alive, should be studied first, then the common, and finally the more obscure forms. The collection of specimens should be encouraged, and the specimens should be made the subject of object-lessons. Human physiology and hygiene being of immense practical importance, their rudiments should be taught in the grammar and even the primary schools. Rudimentary courses in physics and astronomy should be introduced in the highest grades of the grammar school. Physical geography, phænogamic botany, and human physiology should be included in the classical courses in the high school, and required for admission to college.

The Sun-Dance of the Blackfeet.—The most important sacred festival of the Blackfeet Indians is the sun-dance, which is called also by the whites the medicine-dance. The tradition runs that it originated in the thank-offering of a woman for the recovery of her sick child; accordingly, it is usually instituted by a woman who has come successfully out of some trial. It is generally held when the wild fruit is ripe, in July or August, in a lodge especially constructed for it, and may continue for seven days. The ceremonies have been described by the Rev. John McLean, who witnessed them at the Blood Indian camp in Alberta Territory, Canada. The sacred fire was burning in the sun-lodge, and was used by the people for lighting their pipes. The fuel was supplied exclusively by young men who had performed some valorous deed, such as stealing horses from a hostile tribe, and thought the duty an honorable one. Two bundles of birch-wood brush were placed in the form of a cross on the sacred pole. A bower of brush-wood by the side of the lodge was occupied by the woman who had instituted the ceremony, her husband, and a medicine-man, fasting and praying. Prayers were offered at stated times by virgins. Dramatic representations of heroic adventures were given, and sham fights presented representations of actual battles; these were succeeded by feasts of berries cooked in fat, smoking, and conversation. A young man who had been successful in a horse-stealing expedition came up, in fulfillment of a vow, to make himself a sacrifice to the god. An old medicine-woman cut off one of his fingers, held it up to the sun, and dedicated it to him. Two young men presented themselves to be consecrated for admission to the noble band of warriors. One of them stretched himself upon a blanket on the ground. An old man made a speech over him relating his brave deeds, each incident of which was received with applause and music. Then four men held him while a fifth made incisions in his breast and back. Wooden skewers were inserted in the breast incisions, and connected by lariats with the sacred pole, while an Indian drum was fastened to the skewer in the back. "The young man went up to the sacred pole, and while his countenance was exceedingly pale and his frame trembling with emotion, threw his arms around it and prayed earnestly for strength to pass successfully through the trying ordeal. His prayer ended, he moved backward until the flesh was fully extended, and, placing a small bone whistle in his mouth, he blew continuously upon it a series of short, sharp sounds, while he threw himself backward and danced until the flesh gave way and he fell. Previous to his tearing himself free from the lariats, he seized the drum with both hands, and with a sudden pull tore the flesh on his back, dashing the drum to the ground amid the applause of the people. As he lay on the ground, the operators examined his wounds, cut off the flesh that was hanging loosely, and the ceremony was at an end."

The Selkirk Mountains and their Glaciers.—The Selkirk Mountains are situated in the southern part of British Columbia, west of the main range of the Rocky Mountains, within the great bend of the Columbia, and are crossed by the Canadian Pacific Railway at the height of 4,313 feet above the sea. As seen from the Columbia between the two ranges, they rise in gentle slopes and tiers of foot-hills richly clad in pine forest, and cleft by far-reaching valleys, while the Rockies, on the other side of the observer, tower up "from almost barren benches of white silt, with a sparse sprink-

ling of Douglas firs, in great bare precipices of pinkish-white limestone to rugged mountain forms at once." The level of perpetual snow among them is given by the Rev. W. S. Green, who visited them to examine their glaciers, at about seven thousand feet, and the upper limit of the forest at six thousand feet, while the principal peaks rise to between ten and eleven thousand feet. The starting-point of Mr. Green's excursions was the Glacier Hotel station of the railway, in front of the great Illecewaet Glacier, 4,122 feet above the sea. Seeking some commanding point whence a view might be gained of what lay beyond the upper snow-field, the author reached a little peak on the southern shoulder of Mount Sir Donald, six hundred feet below the main summit (10,645 feet). Hence "we had," he says, "one of the most interesting views it is possible to imagine. Now for the first time we saw what the glacier regions of the Selkirks really meant. From the base of the peak we were on, the great snow-field extended for over ten miles. Beyond it to the southward, and away in unending series, far as the eye could reach, rose range after range of snowy peaks with glaciers in the hollows; peaks and glaciers were simply innumerable. Looking westward and northward, a similar prospect presented itself." Of these glaciers, Mr. Green has mapped the Sir Donald, Geikie (four miles long and one thousand yards wide), Deville, Dawson, Van Horne, Asnekan, and Lily. All the glaciers show evidences of shrinking. Measurements made at the foot of the Great Illecewaet Glacier indicated that the ice had moved along twenty feet in thirteen days.

Mental Powers of Criminals.—The bearing of education on the character and reformation of criminals is discussed by Dr. Hamilton D. Way in a paper on the physical and industrial training of that class, which is published by the Industrial Education Association. The author assumes that "it is a mistake to suppose that the criminal is naturally bright. Moral failure and blunted intellect, as a rule, go hand in hand. If bright, it is usually in a narrow line and self-repeating." The criminal's malpractice has its origin in blunted or non-developed nervous areas, and is indicative of wrong-headedness. Whatever may be said of the motives or incentives that led to crime, the fact remains that the head of the criminal is wrong. The time has gone by in which to argue that to educate the criminal is to make him a more accomplished and successful scamp. "It is through physical and mental training and their composite labor that the slumbering germs of manhood are fructified, maturing under a firm and unrelaxing discipline." The criminal's mind, "while not diseased, is undeveloped, or it may be abnormally developed in certain directions; the smartness resulting therefrom partaking of low cunning and centering about self. He is deficient in stability and will-power, and incapable of prolonged mental effort and application. His intellect travels in a rut, and fails him in an emergency. His moral nature shares in the imperfections of his physical and mental state." A training is advocated by the author that will awaken the slumbering faculties, and thus set the mind in a normal condition. This training had best not be given by persons connected with the prison, for it might thereby be unpleasantly associated with penal features, but by teachers brought in for the purpose. Dr. Way gives an interesting relation of experiments which he has made with prisoners in accordance with these views, the average results of which are very encouraging.

The Advantages of Insensibility.—An English writer has recently suggested that we are wont to give excessive praise to the faculty of sensibility, while we depreciate its opposite, or the want of it, insensibility. It is clear, he maintains, that almost every shade of insensibility has a side of advantage as well as of disadvantage. The world forgets how very much tender sensibility often interferes with the calm judgment necessary for right action and the cool presence of mind which is essential to effective execution. What shall we say of the surgeon or the nurse who is so sensitive that the sight of suffering disturbs the judgment and makes the hand tremble when a steady hand is most essential to efficient work. It is obvious that, for every purpose of alleviating pain itself, a certain measure of insensibility to sympathetic pain is in the highest degree advantageous, if not neces-

sary. The best nurses are the calmest nurses, and they are very seldom the ones who suffer most at the sight of their patients' suffering; and "one of the great advantages which patients feel on entering a hospital is that their sufferings do not come back reflected from the faces of those around them; that the sympathy they excite is only a mild sympathy, and not one which heightens their own pain. . . . Hardly a sufferer exists who is not the better instead of the worse for seeing that those around him are *not* overwhelmed by his sufferings—that, so far as he can go out of himself at all, he may get a little relief by entering into the less overshadowed lines around him, and tasting indirectly another's enjoyments."

A Theory of Volcanic Action.—Mr. J. Logan Lobley explained in the British Association last year a theory of the causes of volcanic action which he had reached while keeping in view forty-two leading and controlling facts. His conclusions are, that the primary cause of the formation of lava is the internal heat of the globe inducing chemical action in subterranean regions when the materials and conditions are both favorable; that since the fusion-point of solids is raised by extreme pressure, the conditions for chemical action may be changed by the removal of vertical pressure or its relief by lateral or tangential pressure; that certain substances are fusible at low or moderate temperatures, and that thus at very moderate depths chemical action may be locally commenced that will extend until sufficient heat is produced to effect rock-fusion; that the cause of the ejection of lava from its source, and of its rise in the volcanic tube, is the increase of bulk consequent upon the change from the solid to the fluid state, aided by the formation of potentially gaseous compounds by chemical reactions among the original materials of the magma; that the ascent of the lava in the volcanic tube may be affected by the weight of the atmosphere and by lunar attractive influence; that the explosive effects of volcanic eruptions are altogether secondary, and are due to the access of sea and land water to fissures, by percolation through cool rocks, up which lava is ascending; that this water, when converted into steam, opens, by its expansive power, rents that admit large flows of sea-water to the lava, occasioning the formation of vents and the greater explosive phenomena of eruptions. The formation of the actual surface volcano and the determination of its position are therefore due to the sea, near which volcanoes are almost always situated. Emissions of lava without explosive effects are from volcanic tubes to which large flows of water have not obtained admittance; and, on the other hand, purely explosive eruptions, without lava-flows, are caused by water reaching lava which fails to rise to the surface of the earth.

Fire-proof Houses in Buenos Ayres.—They build fire-proof houses in Buenos Ayres and Montevideo without thinking of it, and while using all the wood they can afford to; and they use neither iron nor the arch. Trees are scarce in the neighborhood, and timber has to be brought down from the upper waters in hard woods. Being dear, a little of it is made to go as far as possible. The floors and the roofs are supported by joists of hard wood, as among us; across these are laid flat rails of the same, and the spaces between these are bridged over by thin bricks thirteen inches and a half long, with their ends resting on the rails; another layer of bricks is then laid with lime, and generally on this a layer of flat tiles. The doors and windows have no boxes, but simply frames, which are set up when the walls are going up, and built in. There is no lathing, or wainscot, or skirting of the bottom of the walls. A house thus built can not be burned.

Glass-Blowing by Machinery.—A system for glass-blowing by machinery, under which mouth-blowing is dispensed with, has been devised by Mr. Howard M. Ashley. In the machine, the molten metal is delivered into a receptacle called a *parison*, which holds just enough metal to form a bottle. At the bottom of the receptacle is a collar mold, which forms the ring around the mouth. The central portion of the mold—which may be described as a punch within a punch, from the method in which it works up into the molten glass to make the collar—is hollow, and is connected with a reservoir of compressed air. After the collar is molded, the mold is turned upside down, a little air

being at the same time admitted. The metal begins to elongate gradually by gravity, and its fall is regulated. When it has attained the required length, the bloom is inclosed within the two halves of the mold, and the bottom of the mold is also placed in position. At the same moment the air is fully turned on, and the bottle is blown out to the full shape of the mold. The result is a complete bottle of the same thickness of glass throughout, and of perfect form and accuracy in every part. A pair of these machines, with one youth and three boys to serve them, are competent to turn out an average of one hundred and twenty bottles per minute per machine. The capacity of the system is greatly increased in the repeating-machine, which is quadrupled, and operates in a continuous cycle, as follows: while the first bottle is being automatically discharged, the second bottle is being finished, the third one is being punched, and the fourth is being cast—that is, the metal is being filled into the mold by the "gatherer," or server of molten metal.

Do Squirrels play 'Possum?—In a paper on the intelligence of squirrels, with special reference to feigning, communicated to the Royal Society of Canada, Dr. T. Wesley Mills gives two cases of the behavior called feigning, by chickarees or red squirrels, and then proceeds to discuss several views advanced in explanation of this habit. Feigning death has been observed in many different genera of insects, in snakes, fishes, numerous birds, crustaceans, and several mammals. In the case of insects, Preyer would ascribe the so-called shamming death wholly to cataplexy (hypnotism), which Dr. Mills deems highly probable. Couch would explain certain behavior of wolves, foxes, and some other animals, usually set down to deliberate feigning, also by an effect analogous to cataplexy. He thinks their senses are stupefied by surprise, terror, etc., so that they are unable to escape. Dr. Clarke adds to this explanation the idea that the quiet of animals when restrained, in many cases is due to an intelligent perception that struggle is useless. Dr. Mills is convinced that Romanes in discussing this subject has imported difficulties into it which are not in the nature of the case present. First, is it at all essential to "feigning" either death or injury that an animal should have, as Romanes supposes, the abstract idea of death at all? It is to be remembered that in these cases the animal simply remains as quiet and as passive as possible, which is in accord with all an animal's experiences as to escape from danger by any form of concealment. A great part of the whole difficulty has probably arisen from the use of the expression "feigning death." What is assumed is inactivity and passivity, more or less complete. This, of course, bears a certain degree of resemblance to death itself. In regard to the behavior of his red squirrels, Dr. Mills is inclined to think that "by inherited instinct, as well as by all those life experiences which had taught them that quiet and concealment of their usual activities were associated with escape from threatened evils, these little animals were naturally led, under the unwonted circumstances of their confinement, to disguise in an extraordinary degree their real condition, and even to imitate an unusual and unreal one." He has reason to believe also that the hypnotic element may play a part in the apparent feigning of death by squirrels. "It thus becomes manifest," he continues, "how varied and also how complex these cases of so-called feigning may be. The subject is all the more interesting, because it shows that there is much that is common in the psychic life of human beings and that of the lower animals. It places the study of their habits and intelligence on a higher plane, and furnishes new motives for extending our inquiries and attempting to give unity to our conception of nature in this as in other domains."

The Bronze Buddha of Nara.—The old bronze images in Japan are remarkable alike for their enormous proportions, the method of their construction, and the excellent character of the alloy composing them. The largest and most remarkable of them is at Nara, some miles eastward of Kioto, which was erected about A. D. 1100. It is fifty-three feet six inches high and more than twenty-eight feet broad across the shoulders. On its head are 966 curls; and the image is surrounded by a glory or halo seventy-eight feet in diameter, on which sixteen images, each eight feet long, are cast. Two

smaller images, each twenty-five feet high, stand in front of the larger one. The total weight of metal in the main figure is about 450 tons, and this is said to consist of gold, 500 pounds; tin, 16,287 pounds; mercury, 1,954 pounds; and copper, 986,080 pounds. The large images are not cast in single pieces, but are built up of numerous small pieces of irregular shape, which are cemented together by a substance of unknown composition, that takes on the same tarnish as the bronze.

Forestry in the Cape Colony.—No care was taken of the forests of the Cape Colony until 1880, when many valuable tracts had been nearly destroyed. Measures were taken in that year for their future preservation, and the Count de Vaeselot, who had had a large experience in French forestry, was appointed forest superintendent. He divided the forests into districts and these into sections, in which the felling should proceed so that the regrowth of the first section should be given time to develop into mature trees before the axe should be used there again. By this system the entire shutting up of any forest for a time is done away with. The period for the "revolution" of felling is fixed at forty years. The forests severally are watched over by a staff of foresters and inspectors, under whose supervision all cutting goes on, and who attend to the raising and planting of young trees. The Government has established large tracts of plantations and nurseries from which the forests and private holders are supplied; has begun a reafforestation of Table Mountain; and has instituted an "arbor day," which is observed with great enthusiasm.

The "Heaps of Joy" of Saint-Pilon.—Tourists have often noticed little heaps of stones on the higher peaks of Mont Sainte-Baume, Provence. They are called *castellets*, or little castles, and are either composed of several stones forming a sort of rude pyramid, or of one large stone inserted in a fissure of the rocky soil. They are most frequent in the vicinity of the Oratory of Saint-Pilon, where they are found at an elevation of nearly one thousand feet. Dr. B. Féraud has learned that they are also locally called *moulons de joye* (heaps of joy), and that, besides being intended to testify to the successful ascent of pilgrims to the summit of Saint-Pilon, they were frequently designed to propitiate St. Magdalen, to whom prayers are made on the spot for approval of the special maiden whom the worshiper may desire to marry. In the latter case the mound is visited by the builder at the end of a year, and if he finds the stones undisturbed, he considers that the saint approves of his choice; but if the heap is broken up, it is generally regarded as a decisive barrier against the intended marriage. In this superstition Dr. Féraud sees a survival of the ancient usage of erecting stone monuments, such as altars, pillars, menhirs, etc., to commemorate some important personal event.

Sign-Talk in New Guinea.—An exploration was made some months ago by Mr. Theodore F. Bevan of the Philp and Queen's Jubilee Rivers, hitherto unknown affluents of the Gulf of Papua, in southern New Guinea. In the course of his voyages the traveler met several bands of natives who had apparently never before seen white men, intercourse with whom brought out some curious characteristics and capacities of the sign-language. At Attack Point, on the Aird River, the progress of the party was opposed by some sixty nude Papuans, who, after a little hesitation, bore down upon them, "alternately splashing the water into the air and beating time with their paddles against the sides of their canoes, also shooting volleys of arrows at us. . . . This attack was decided in our favor, without any bloodshed, by a judicious use of the steam-whistle and a few shots fired wide and high." The savages were painted, decorated with feather head-dresses in addition to other ornaments, and wore white groin-shells to partly conceal their nudity. At Tunui, on Philp River, the natives dressed their persons and canoes in green boughs in manifestation of their friendly feelings, and were responded to by the whites with dumb motions and words likely to be recognized by them. The next step from this side was to bind a slip of Turkey-red cloth, a piece of sharpened hoop-iron, and one or two trifles upon a wooden batten, and let it drift down-stream. "One native, bolder than the rest, paddled after this parcel, and, after cautious inspection, appropriated it, and donned the red cloth as

a covering for his frizzly hair. On another visit from the natives, one was horrified at seeing salt beef in a cask, and another was terrified at seeing his own ugly reflection in a mirror. They had become tired of the white men by this time, and signified it by waving their arms down-stream. "One very old and wrinkled man rubbed his nose and pinched the tip of it, and rubbed the pit of his stomach. Another signified by signs the act of cutting off the head and arms, using the words 'oorar' and 'badinar.'" With a tribe called Kiwa Pori, in the delta of the Queen's Jubilee River, one of the signs was to hide their lowered heads in their hands and then to draw their hands down ever cheeks, mouth, chin, neck, breast, and abdomen. These men were of unusually fine stature, and dark bronze in color; but, though with well-nourished and muscular frames, "their retreating foreheads and heavy eyebrows gave them a sinister expression." One tribe always spoke the name of the sun in a whisper, with finger pointing upward and averted gaze. In a deserted hut, which exceeded the others of the village in size, was found fixed up in front a "taboo," consisting of a painted mask resting on a large circular wisp of sago-palm fiber and rattan, with pendent streamers of the same fibrous material; while half-way down the floor of the hut were bones of fishes and small deer suspended from streamers. All of the new tribes wore nose-pencils, distended the lobes of their ears, and smoked sun-dried tobacco by means of bamboo tubes. The canoes of all the tribes were dug-outs, with either a bank of mud or a small boy squatting in the prow and opposing his back to the incoming water. Some of them were very large. In one, twenty-nine men stood up to paddle.

Polishing Telescopic Objectives.—The shaping and grinding of telescopic objective lenses are operations requiring great care and delicacy in execution. In polishing, softer powders and softer tool-surfaces must be used than in grinding. Of all the substances that have been used for the face of the polisher, pitch, or the natural bituminous deposit from Archangel, which was first employed by Sir Isaac Newton, is, according to Mr. Howard Grubb, still the best. It has the important qualities of perfect inelasticity and a property of subsidence. Cloth can not give a perfect surface, because it is apt to round off the edges of the pits left by the grinding-powder, and to polish their bottoms as well as the real surface of the lens. Pitch wears away the surface evenly, and does not take hold of the pit-bottoms till the whole is ground down to a level with them. Although pitch, by boiling, can be made so hard that an impression can not be made on it with the finger-nail without splitting it in pieces, it will, even in this condition, if laid on an uneven surface, in time subside and take the form of whatever it is resting upon. This property, by virtue of which it may be considered technically a liquid, is taken advantage of in the manipulation of the polishing process to produce a surface exactly even and true. It appears to be peculiar to pitch, some of the resins, and ice; although it has been observed, in a vastly inferior degree, in some metals. It is a curious circumstance that the same quality which in ice allows gradual creeping and subsidence, and the consequent formation of glaciers, should in pitch help us to produce accurate optical surfaces.

Italian Butter.—The Italians do not excel in the manufacture of butter. It is produced considerably only in four districts, of which Lombardy furnishes the best, usually through the market of Milan. The butters of Reggio and the Tyrol are used for mixtures, and those of Æmilia and Sorrento are unimportant in quantity. In the rest of the country, oil, fat of American origin, or substitutes are used for daily wants. According to the French consul at Milan, the principal obstacle to the development of the trade in pure butter is the increasing use of these substitutes, and artificial butters, which are imported from America, France, Germany, England, and the Netherlands. "The demand for butters in Europe, South America, Australia, India, Japan, and even China, has become so important that, in presence of the insufficiency of the natural product, it became necessary to manufacture an analogous substance, so that in Holland and Denmark, the principal countries producing pure butter, the artificial butter industry was undertaken without fear of prejudicing the pure

article. It was not long before Italy followed the example of these two countries, but the first attempts were not fortunate." Italian margarine butter costs from forty to forty-five per cent less than pure butter, and is more easily handled.

NOTES.

THE "Hand-Book of Meteorological Tables," compiled by Prof. H. A. Hazen, contains in a convenient form the reductions needed for current work, omitting those not now generally used. Several of the tables are new, or recomputed in their present form after some years' experience by the author in their use. The table for reduction of barometrical observations to sea-level has been extended to eight thousand feet. Formulæ and tables are given for the determination of mean wind direction, and for the conversion of wind velocities from miles per hour to metres per second, and *vice versa*.

THE Society or Association of Sanitary Inspectors of Great Britain is composed of the professional inspectors who act under the direction of the medical boards of health. The "Lancet" claims that a great improvement has come over the character of these officers since the society was formed, five years ago, and that they have gained greatly in influence. The examinations by the Sanitary Institute have also contributed materially to raise the standing of these men. The diploma of the institute conveys no legal license or corporate privilege, but it is a testimonial of qualification, a badge of honor, and a stimulant to earnest work and improvement.

THE Watson gold medal and $100 in gold, founded by Dr. James C. Watson, to be given to the citizen of any country who has made the most important discoveries in astronomy, has been awarded to Dr. Edward Schönfeld, of the University of Bonn, Germany. The medal is given to Dr. Schönfeld for his researches concerning the variable stars and for his work in cataloguing the stars brighter than the tenth magnitude, from the equator to the southern tropic.

THE Congress on Tuberculosis that was held in Paris in the summer of 1888 recommended the inclusion of that affection in the list of contagious diseases of animals, and the seizure and destruction of every infected beast. It urged the spread of popular instruction respecting the precautionary methods for preventing tubercular contagion, the risks that are run by the infection of meat and milk coming from tuberculous cattle, and the measures to be taken for the disinfection of materials derived from phthisical patients. It insisted on the inspection of dairies and dairy farms.

A LOWLAND cure has been suggested by Dr. Lindsley, to be applied in places below the level of the sea, where the atmosphere is denser than at normal or higher levels. Such places are the valley of Conchilla, near Los Angeles, California, about two hundred and seventy-three feet; the Dead Sea district, twelve hundred and eighty-nine feet; Lake Asal in East Africa, six hundred and thirty-nine feet; the Arroyo del Muerto, California, two hundred and thirty feet; the oasis of Sirrah in Libya, one hundred and twenty-three feet, and the borders of the Caspian Sea, eighty-six feet below the sea-level.

COLORADO possesses large coal-fields which yielded 1,439,811 tons in 1886. The valuation of coal on the cars, at $2.35 per ton gross, was $3,375,095. About 3,500 men are employed. The average cost of producing the coal on the cars at the mines is $1.74 per ton. The fields yield anthracite, bituminous, and lignite coals; and it is thought by the officers of our Geological Survey that about 100,000 square miles of the territory of the State are underlaid by coal-bearing strata.

THE monument to be placed over General Prjevalsky's grave on the shores of Lake Issik-kul will represent a rock twenty-eight feet high, on the top of which a large eagle is perched. The eagle grasps in its talons a map of Central Asia, the arena of the scientific exploits of the deceased, and in its beak an olive-branch, symbolical of the peaceful scientific conquests which Russia owes to Prjevalsky. The inscription, recording the name, birth, and death of the deceased, on one side of the rock, is surmounted by a large bronze cross. In the interior of the monument is cut a spiral staircase crowned with an enlarged copy of the medal struck by the Academy of Sciences in 1887, and showing the inscription, "To the first explorer of Nature in Central Asia."

BISHOP'S Ring was seen in February, 1889, by Miss E. Brown, of Cirencester, England, at about noon one day when the sun was hidden behind a cloud. It appeared very similar in extent and color, but not in intensity, to its exhibition after the Krakatoa eruption.

IN a paper on "Destructors and Refuse Furnaces," read before a Yorkshire Sanitary Science Conference, Mr. W. Warner said that a chimney one hundred and sixty feet high was suitable for the cremation, and could be built, with a six-celled destructor, for about £3,000, or $15,000. If a town could utilize all the clinkers, fine ashes, and fine dust, it would pay the cost of burning and the return of capital expended on the plant, and produce a revenue to aid the necessary cost of erection. The author did not see why the point of perfection should not be reached.

In a paper in the British Association on "Tattooing," Miss A. W. Buckland said that in Africa, Australia, and the islands of the Indian Ocean, tattooing consists of a series of short cuts which heal, leaving cicatrices. In New Zealand, America, the Pacific islands, among the tribes of India, and in Burmah, Borneo, and New Guinea, patterns are first drawn upon the skin, and then punctured with thorns, needles, or splinters of human bones. Color is then rubbed in. The process is very painful and can only be carried on at intervals, several years being sometimes required for its completion. Among men tattooing is valued as a mark of bravery. In the case of women devices are worked upon the chin to signify marriage.

After his ethnological researches in Egypt, Prof. Virchow has concluded that the fellaheen do not exactly represent the ancient inhabitants in their physical aspect. The evidence afforded by the oldest sculpture and the earliest skulls shows that the primitive type was brachycephalic, whereas the types of the present time and of many centuries past are dolichocephalic and mesocephalic. It is uncertain whether the change was produced by the environment or by the influx of new races; but Prof. Virchow inclines to the latter view.

The principal and most useful wood in Borneo is *bilian*, or iron-wood. Its characteristics, as mentioned by Mr. R. T. Pritchet, are hardness, density, and being ant-proof. It is the best shingle wood, and, being large and plentiful, the most valuable timber. Other sinking woods are *russock*, *grealing*, *mirabou*, the last of which, a heavy, dark-yellow wood, is valuable for furniture and takes a fine polish; camphor-wood, and a red wood, and *sirayah*, which gives logs five feet in diameter and forty feet long.

Observations made by M. Janssen on Mont Blanc for the purpose of deciding whether certain lines in the solar spectrum are due to oxygen in our air or in the solar atmosphere, showing the lines weaker than at lower levels, seem to prove that they are due to our atmosphere.

The *nipa* is a palm-tree of Borneo which grows in the swamps above the mangrove, where the water begins to be brackish. It revels where the swamps are more fresh than salt, its leaves growing boldly and imposingly to a height of twenty feet and upward. House-thatching is principally made of these leaves stitched together, which form roofs well adapted to turn away the heat. The *kadjan* mats, which travelers find very useful, and will fold up into very small compass, are also made from them.

The pest of locusts has been fought vigorously and successfully in Cyprus by gathering the eggs and catching the developed insects in systems of screens. The number of eggs collected increased from 37½ tons in 1879 to 236 tons in 1880, and 1,330 tons in 1881. More than 6,000 screens were employed in 1882, and 195,000,000,000 insects were destroyed. The system was steadily made more effective, and in 1886 there were available for use more than 11,000 screens and 13,000 traps, the screens representing an aggregate length of about 315 miles, or nearly the whole coast-line of the island.

It sounds odd to read in a paper by Robert Wallace, on Indian agriculture, that the Manchester Chamber of Commerce is cooperating in an attempt to "reduce the amount of refraction" or impurities to be recognized as a "trade custom" in the sale of wheat from six or seven to two per cent. Regarding the present custom, it has been estimated, according to Mr. Wallace, that the direct loss to the community is equivalent to the sum of fifty thousand pounds a year, "spent upon the absolutely unremunerative work of shipping or carrying sand or clay which had been added to the cleaner samples of wheat with the deliberate object of netting an unjust gain."

OBITUARY NOTES.

Maria Mitchell, a distinguished astronomer and professor in Vassar College, died in Lynn, Mass., June 28th, of disease of the brain, from which she had been suffering for about eighteen months. She was born in Nantucket, in 1818, the daughter of an amateur astronomer, and studied under her father and Charles Pierce. At eleven years of age she recorded the time of the beginning and ending of an eclipse of the moon. In 1847 she discovered the first of her eight comets. She was the first woman to be elected to the American Academy of Arts and Sciences; was a member and fellow of the American Association for the Advancement of Science; an LL. D. of Hanover and Columbia Colleges; and was actively interested in measures to elevate woman's work. She resigned her professorship at Vassar College in January, 1888, but no action was taken on her resignation, so that she still remained the titular incumbent.

Reichenbach, the eminent botanist, has recently died in Hamburg, aged sixty-seven years. He was best known from his investigations of orchids and hybrids.

Dr. George Owen Rees, F. R. S., died in Mayfield, England, May 27th.

Dr. Paul Du Bois-Reymond, a brother of Dr. Emil Du Bois-Reymond, died in Freiburg, Baden, April 7th, in his fifty-ninth year. He was Professor of Mathematics at the Technical High School of Berlin; was formerly at the Universities of Freiburg and Tübingen; and was the author of two well-known mathematical works.

Joseph Lovering